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IMPROVEMENT IN THE VENTILATION OF RAILWAY TUNNELS.

The earlier forms of railway tunnels were built without much reference to the comfort of passengers in respect to ventilation, but the increase of travel, the competition of rival lines, and the demands of an intelligent spirit of improvement have caused renewed attention to be given to the subject. The city of London is traversed in all directions by underground railways, which by their celerity, safety and reliability have become established, in popular favor, as the best means for local travel. Without encumbering any portion of the street surfaces, without creating noise or nuisance to inhabitants along their lines, they afford the most extensive facilities for rapid transit. On a recent holiday in London, the enormous number of 250,000 persons were, it is said, conveyed over the London Underground Railway, and this without taxing the road to the limits of its capacity. The rapidity with which the trains move is something astonishing. The stations are about half a mile apart, and each train, composed of ten or twelve short cars, is equal in length to five or six of the long sixty-seat American cars. During the busy portions of the day, the trains pass each way every two minutes, and it is within this brief space of time that a train starts from one station, moves to the next station, and then discharges and takes up passengers. The Underground Railways of London are composed of many short sections of tunnels, with open spaces between. When the tunnels were built—some ten years ago—but little care was bestowed upon their air supply. The increase of traffic has, however, rendered it desirable to adopt special means to promote ventilation. This has been done at several points by the erection of air shafts at the sidings and sta- tions.

Probably the finest, as it is the latest, example of underground railway construction is that of the Harlem Railway on Fourth Avenue in this city. This great work was fully illustrated and described in our paper last year. The ventilation of the tunneled portions of this road is effected by large openings, made at intervals through the roof of the central tunnel into the street above. The ventilation is fair and gives much satisfaction.

But a still more effective method is that in which the ventilation is done by mechanical means. The tunnel being nothing more or less than a walled chamber, it is only necessary to apply a fan, in a suitable manner, and the entire air contents of the tunnel may be unerringly changed, every minute, or less frequently, as may be desired.

The well known railway tunnel of the London and Northwestern Railway, under the city of Liverpool, is now ventilated by means of a single steam fan of large dimensions, placed near the center. This mechanism changes the entire contents of the tunnel in about eight minutes. Such a ventilation gives a purer atmosphere than that enjoyed by the majority of people within the apartments of their homes or places of business.

Our excellent cotemporary *Engineering* gave an estimate not long ago, showing that the underground railway tunnels of London might be mechanically ventilated, by taking the air from them at or near the several stations, by engines of three horse power, at a fuel cost of only about six to eight cents per mile per hour, the air being changed hourly.

The improvement we herewith illustrate is intended for the same general purpose, and is the invention of Mr. Joseph Dixon, of the Broadway Underground Railway of this city. Patented May 25th, 1875. The invention consists in the combination of one or more partitioning doors and a blowing apparatus, with the tunnel. As shown in our engraving, the blowing apparatus, operated by steam, is seen in a chamber at the right of the tunnels. The blower communicates by a horizontal air pipe, shown in dotted lines, with the roofs of the tunnels; and when the tunnel doors are closed and the blower set in motion, three will be a strong exhaust or outflow of air from the tunnels through the blower, which discharges into an adjoining chimney, the fresh air entering at the opposite ends of the tunnels, which are always open. The blowers may be used to force fresh air into the tunnels, if desired.

This method will at once commend itself by its simplicity, effectiveness, and economy. The plans of the inventor include the opening and closing of the tunnel doors automatically by the movement of the cars, by means of a simple arrangement of levers. For further information, address the patentee, Joseph Dixon, 263 Broadway, New York.

Lady Jane Franklin.

The fact of Lady Franklin's illness has been known for a considerable period, so that the news of her death, which occurred on the 18th of July, is not unexpected.

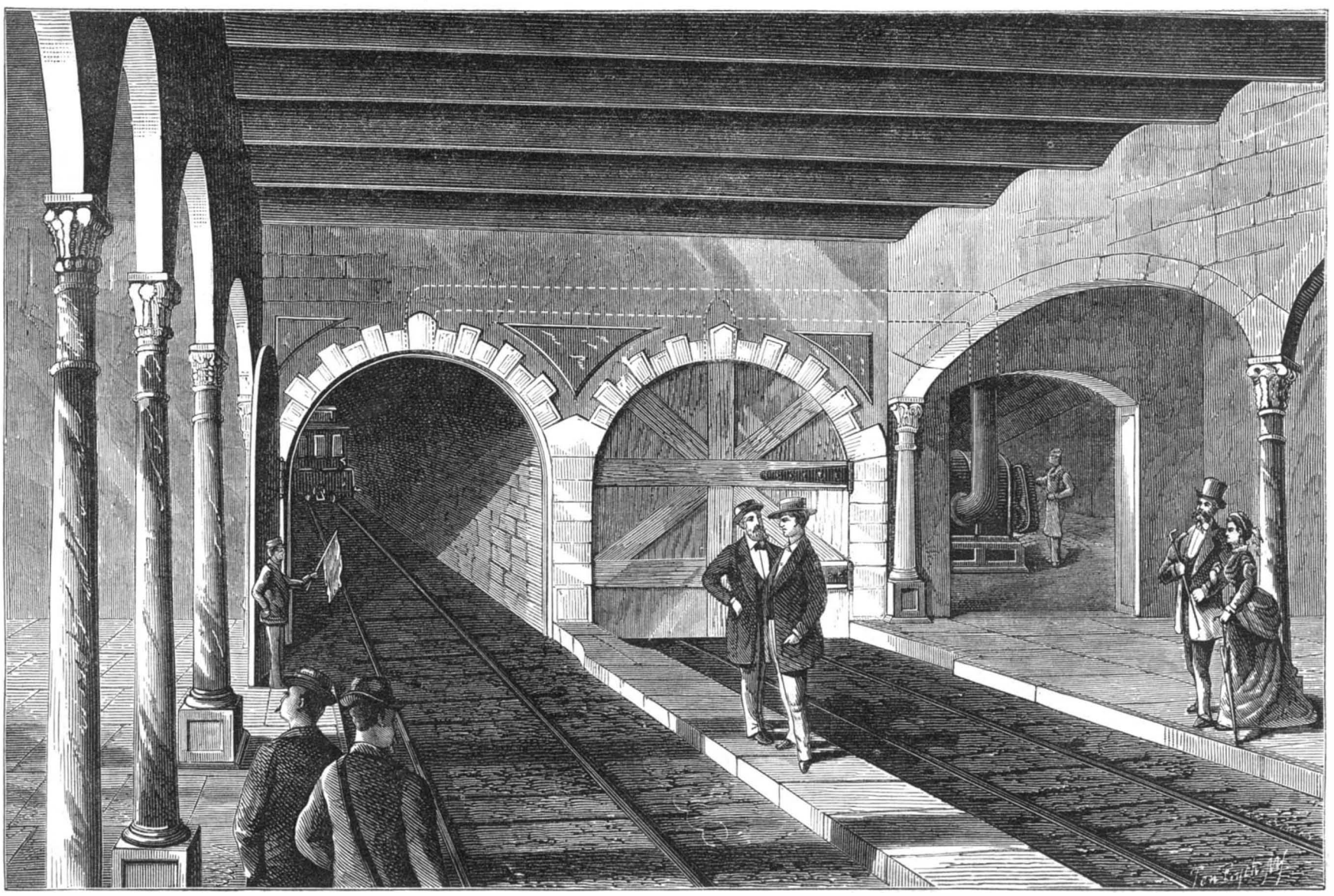
Sir John Franklin sailed in search of the northwest passage in May, 1845, with a small and poorly equipped expedition composed of the ships Erebus and Terror. In 1847, no tidings of the party having reached England, Lady Franklin began that series of heroic efforts at first to rescue her husband, and subsequently, after his fate had become known, to regain his remains or the records of his labors which she always believed he had left behind him. In 1848, she offered rewards of $10,000 and $15,000 to any persons who would carry relief to the missing explorers or attempt so to do. In 1849, she sent, through the President of the United States, a touching appeal to the American people for aid in her search. The Grinnell expedition was the response. In the following year, and subsequently, Lady Franklin fitted out numerous expeditions at her own cost, all of which, however, proved unsuccessful. In 1857, the steamer Fox, under the command of Captain Leopold McClintock, was despatched by her, and this vessel, after three years' sojourn in the arctic regions, returned with the first definite news of Sir John Franklin's death and of the abandonment of the Erebus and Terror.

The reception of this sad intelligence in no wise abated the interest felt by Lady Franklin in all matters concerning arctic expeditions. She still sought further tidings of her husband's expedition, and offered liberal rewards for the same. In 1870, although at the advanced age of sixty-five years, she came to this country in order to converse with Captain Hall, previous to that explorer's departure on the Polaris voyage.

Three years ago Lady Franklin purchased a mansion in England for the reception of the relics of Sir John's party. No one was more engrossed than she in the objects of the expedition which has just left England, and before its sailing she again offered rewards for the discovery of the last message which she was certain her husband had written her, and deposited in some place of safety.

Some three weeks ago, Lady Franklin sent by telegraph a request to the Christian people of this country, that they would remember her in their prayers on the following Sunday. The knowledge that her appeal met with an earnest and hearty compliance probably mitigated the last sufferings of one whose whole life will pass into history as a model of pure and wifely devotion.

COAL ashes, sifted very finely, thoroughly ground, and mixed with oil, make a good cheap paint. Any coloring matter may be added.



IMPROVEMENT IN THE VENTILATION OF RAILWAY TUNNELS.

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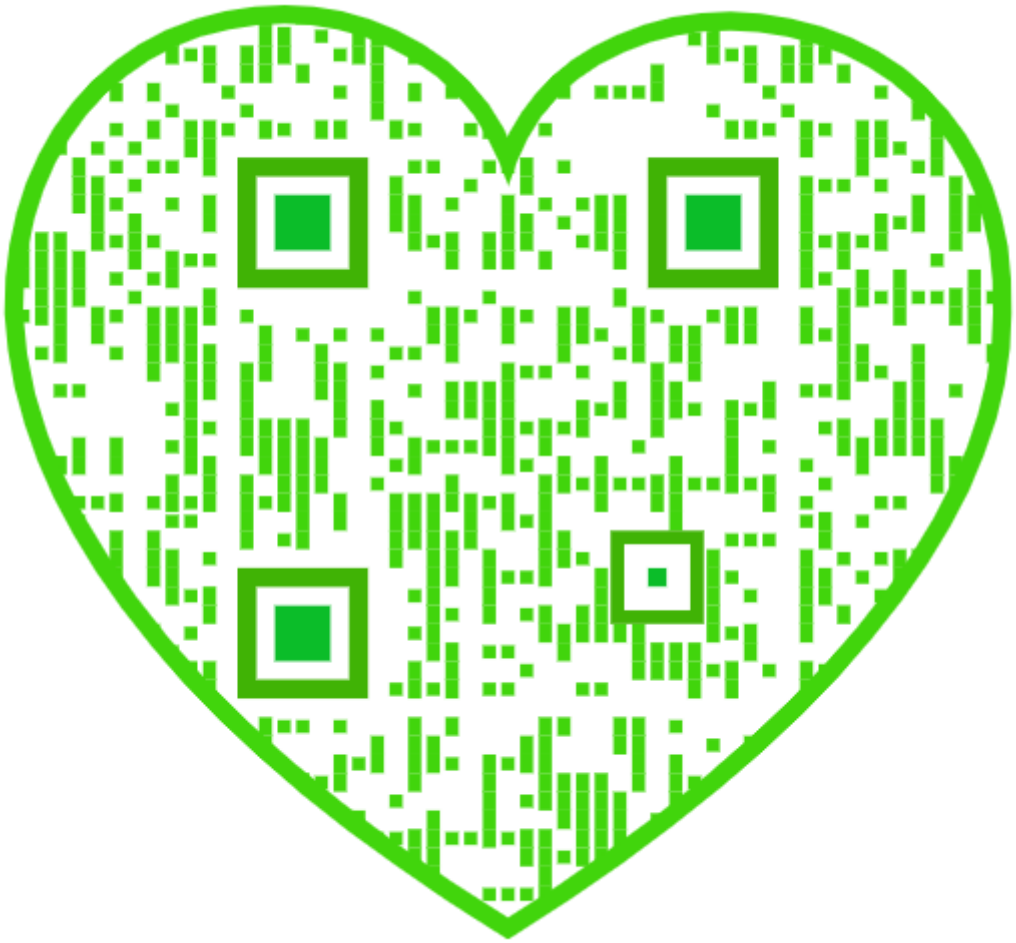

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PHYSICAL LIFE AFTER DEATH.

Man is a physiological trinity. His life is threefold. At the base, and embracing the phenomena of circulation and nutrition, is the organic life, as Bichat terms it—the life which the animal shares with the plant. Resting on this is the animal life, as exhibited in the phenomena of the sensory nervous system; and intimately connected with the latter, as its highest development, is the mental life, characteristic of man. These three are one, but not inseparable. They are not born together, nor do they always die together.

Death is not a simple phenomenon, nor one of instantaneous occurrence. When man dies normally, as of old age, he dies like a tree, in detail, beginning at the top. The series of slow and partial deaths which, with the old man spared by disease, result in the last end of all is eloquently described by Papillon.

"All the senses in succession are sealed. Sight becomes dim and unsteady, and at last loses the picture of things. Hearing grows gradually insensible to sounds; touch is blunted into dullness; odors produce but a weak impression; only taste lingers a little while. At the same time that the organs of sensation waste and lose their excitability, the functions of the brain fade out little by little. Imagination becomes unfixed, memory nearly fails, judgment wavers. Motions become slow and difficult on account of stiffness in the muscles; the voice breaks; all the functions of outward life lose their spring. Each of the bonds attaching the old man to existence parts by slow degrees. Yet the internal life persists. Nutrition still takes place, but very soon the forces desert the most essential organs. Digestion languishes the secretions dry up, capillary circulation is clogged, in their turn that of the large vessels is checked, and at last the heart's contractions cease. This is the instant of death. The heart is the last thing to die."

This orderly sequence and painless closing of life is, however, comparatively rare. Sometimes the mind dies long before the animal life is seriously affected, as when death is preceded by years of imbecility. Sometimes death seizes first upon the extremities and creeps upward, the mental powers remaining intact to the last. Again the mind may flicker with unwonted brilliancy after the animal life has seemed to go out. In all cases, however, the organic life is the last to yield.

A tree does not die instantaneously when felled, though death begins at that moment; similarly life persists in the animal body after the thread of animal life is severed. And as slips from a felled tree may be grafted upon a living trunk, and thus escape the death of the parent stem, so may portions of a dead animal be transplanted to the living, and so have their life perpetuated.

If death were immediate throughout the entire organism, such a transference of members without any interruption of their physiological activity would be utterly impossible.

Thus the vital knot of Flourens, the point in the spinal marrow which that physiologist made the seat and center of vitality, is effectually disposed of. It is true that any disturbance of that portion of the nerve is more fatal than a like disturbance of any other part of the organism; but that is not because it differs in kind from other portions of the nervous system. Life is not more concentrated there than elsewhere; that is simply the initial point of the nerves which animate the lungs; and the breath ceases, and death quickly ensues, when their office is interfered with.

Unlike the remarkable small dog of the nursery rhyme, animals, even the highest of living creatures, do not die "all over" at once. Our bodies are composed of many more or less independent parts, each living its own life, while contributing to the life of the whole, and each dying by itself. The human tissues may not retain their individual vitality so long as those of the lower orders of life, still they are very slow of dying. The hair and the nails continue to grow, and even the complicated processes of absorption and digestion go on for hours after the life of the organism has apparently ceased.

The throbbing of a frog's heart after its complete separation from the rest of the body is often described as a characteristic illustration of the persistent vitality of reptilian structures. But the human heart will do the same. In the case of decapitated criminals, it has been observed that the uncovered heart, even when the stomach, the liver, and the intestines have been removed, will continue the pulsations for an hour or more after the guillotine has done its fatal work. One day when Robin was operating on the body of a criminal an hour after his execution, an example of reflex action was observed as remarkable as any of the seemingly intelligent movements recorded of the limbs of decapitated frogs.

"The right arm," says Robin, "being placed obliquely extended at the side of the trunk, with the hand about ten inches away from the hip, I scratched the skin of the chest, at about the hight of the nipple, with the point of a scalpel, over a space of nearly four inches, without making any pressure on the muscles lying beneath. We immediately saw the great pectoral muscle, then the biceps, then the anterior brachial, successively and quickly contract. The result was a movement of approach of the whole arm toward the trunk, with rotation inward and a half flexion of the forearm upon the arm, a true defensive movement which threw the hand forward toward the chest as far as the pit of the stomach."

Such spontaneous exhibitions of life by the dead are trifles, however, as Papillon observes, compared with those which may be excited by means of certain stimulants, particularly electricity. In evidence he cites the experiments of Aldini on two criminals beheaded at Bologna, and those of Ure, in Glasgow, on the body of a criminal that had remained an hour hanging on the gallows: the details of which are too horrible for repetition.

Less horrible, but not less remarkable and instructive, was an experiment made by Brown-Séquard on the head of a decapitated dog. Having beheaded the animal, taking pains to make the section below the point at which the vertebral arteries enter their bony sheath, the operator fitted to the arteries little pipes, connected by tubes with a reservoir of freshly oxygenated blood. At this stage the head failed to respond to the action of electricity; but when a current of blood was forced into the arteries, irregular motions of the eyes and the facial muscles began, succeeded by regular harmonious contractions, as if prompted by the animal's will. The injection of blood into the cerebral arteries was kept up for a quarter of an hour, during which the mimicry of life was continued. On stopping the injection, the motions ceased, and the spasms of a second death ensued.

The question was raised whether such a temporary renewal of life could be brought about by the same means in a human subject. Brown-Séquard was confident that it could be done, even with the head of one decapitated by the guillotine, provided certain precautions were taken to prevent the filling of the arteries with air. But when it was proposed to him to try the experiment on a condemned criminal, he declined, not wishing, he said, to witness the agony of such a human fragment temporarily recalled to sensibility and life.

Enough has been given to show that life and death are not such simple affairs as is popularly supposed; and that in another sense than the poet meant, it is not all of life to live, nor all of death to die.

We will close with a suggestion to sensational novelists: Having "snarled up" the hero of the tale in a maze of circumstantial evidence, it would make a very stunning *denouement* to save him at last, by means of a *post mortem* confession of the crime by a murderer executed for another crime, the confession to be extorted through the combined agency of galvanism and the transfusion of fresh blood!

Or the clever concoctor of scientific hoaxes for the *World* might surpass himself by giving a detailed account of such an operation on some obscure victim of rural justice, wherein the resurrected man might make confession of the Nathan murder and reveal the whereabouts of Charlie Ross.

THE KEELY MOTOR DECEPTION.

The Chicago *Railway Review* avers that the SCIENTIFIC AMERICAN and other papers have proceeded to kill, dissect, analyze, and condemn Keely's pretended motor, when they confessedly know nothing about its operation or construction. But the *Review* is evidently in error here, for the Keelyites have given many details, not only of the mode of operating the motor and producing the "cold vapor," but also of the manner in which the treasury of the Keely Motor Company was supplied with cash. It is from this information, furnished in pages full at a time by the parties themselves, in their anxiety to get their scheme before the public, that the adverse conclusions complained of by the *Review* have been reached.

The concurrent testimony of the leading members of the Keely Company, as voluntarily published by themselves, is that Keely produces his alleged power by blowing with his mouth, for 30 seconds, into a 3½ gallon kettle, then lets in a little water, then turns a cock, and behold! he has produced a "cold vapor," having an energy of from two to ten thousand pounds per square inch. The inner arrangement of the apparatus, with its pipes, chambers, nozzles, valves, and connections, is described, and great pains is taken to reiterate that no heat, electricity, chemicals, or other substances save air and water are employed, and nothing is done except to operate the faucet. Now you see it, and now you don't, according to the way the cock is turned. Such in brief is the Keely motor. Mr. Collier, the Philadelphia lawyer and financial agent of Keely, testifies that he made three visits to New York, and obtained in all the sum of one hundred thousand dollars from capitalists here. This money, he says, he obtained by exhibiting to the parties the averment of Keely substantially to the above purport, Charles H. Haswell, who had witnessed Keely's performances and personally tested and reported upon the apparatus, being among those present. After a portion of the money was paid, the victims were, by agreement, allowed to witness the motor for themselves, and the balance was then obtained from them. A curious fact in connection with this business is that Mr. Haswell now earnestly denies that he assisted the deception or endorsed the integrity of Keely's operations.

More than a year ago we published portions of Mr. Haswell's report given in endorsement of Keely, on the strength of which, Mr. Collier tells us, he obtained the first ten thousand dollars from the New Yorkers. Mr. Haswell has never until now complained of our comments then made. Under date of June 26, 1875, Mr. Haswell writes another report in behalf of the Keely motor, published by us on page 37, current volume. In this report he confirms, at some length, all that he had previously written, specifies the tests he personally made, and again commits himself in support of the scheme. But in the next breath, he writes us complaining that we have done him injustice, and especially requests us to print the subjoined note for his vindication, which we do with pleasure, leaving him to reconcile, as best he can, the denials which he now makes with the various reports in behalf of Keely which he has placed before the public.

To the Editor of the Scientific American:

Your notice of my query to you of the 17th inst. involves a repetition of it.

Thus: Am I to understand that my mere report of certain results, which I saw developed by a vapor in Mr. Keely's house, are held by you to be an endorsement of the integrity of the operation Mr. Keely claims for the generation of it I being wholly ignorant of the construction of the instrument of generation, or the manner of operating it?

Further, I never was employed, as asserted by you, to test the motor, neither have I done it, or do I know of any one who has.

The gentleman to whom my query was confided appears to have overlooked the fact that observation and analysis are very different matters. I am, respectfully,

CHAS. H. HASWELL.

New York, June 28, 1875.

We have received from all parts of the country many original contributions relating to the Keely motor, *pro* and *con*, also many new plans for motors quite as wonderful, if not exceeding in merit, the Keely device. Our limited space will only permit the publication of a few of them. Among the essays received is one in which the writer bases his advocacy of the Keely nonsense upon the fallacious but popular idea that water, like nitroglycerin, contains a vast amount of force, ready to be liberated by the mere pull of a trigger. We are unable to publish the entire article, but we make the leading thought of its contents the basis for a few remarks in an article upon some of the practical differences between the two substances mentioned.

ENGLISH PATENT LAW DISCUSSION.

We gave a brief abstract not long ago of the Patent Law Reform Bill introduced in the House of Lords by Lord Cairns. The bill was full of objectionable clauses, its main purport being to bring about the abolition of patent grants in England. The aristocracy of Great Britain have reached the conclusion, substantially, that inventors and their patents are a nuisance, do more harm than good, and ought, as far as possible, to be legislated out of existence. So the bill passed the House of Lords, and was sent to the House of Commons, where it now is.

It is almost unnecessary to say that the adverse sentiments of the Lords, expressed during the discussion of the bill and confirmed by its passage, created the greatest dissatisfaction among working men, engineers, manufacturers, and all who have at heart the advancement of knowledge, Science, and useful industry. Meetings were immediately called in remonstrance against the further movement of the bill, and large numbers of petitions to that end from societies and influential personages have already been sent in to Parliament. The prospect now is that the bill cannot pass the Commons, and will therefore fail to become a law.

For several years past there has been going on in England a discussion of reforms thought to be necessary in the patent law, the prevailing idea being that some radical alteration was necessary, although no agreement could be reached as to what precise change was essential. The present endeavor of the Lords to abolish patents has quickened the discussion, and induced a more practical examination of the present law than ever before. The result appears to be that the existing English law, when compared with that of

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other countries, is found to contain many excellences, and the general impression is that it really needs only a few changes.

Under the existing British patent law, any person, whether the inventor or the mere introducer of a new invention, may receive a patent. A specification and drawings are required, but no model. No official examination is made. The question of the validity of the patent is settled by the courts. If the invention described in the patent is proved on trial before the court to have been an old or known device, the grant is void; otherwise, its validity is maintained. The principal points of change now suggested are:

1 A reduction of fees, $875 being the official charges now made for a fourteen year patent.

2. The granting of patents only to inventors, mere introducers of novelties being at present allowed to take patents.

A third point of reform, very strongly discussed, is the propriety of having examiners to decide upon the novelty of the invention, before issue of the patent, as in this country.

The general drift of the discussion on this head in England appears to be that, while an official preliminary examination has certain advantages, it is also attended with serious disadvantages; and that, on the whole, it would be better to let the law stand as it is, leaving the applicant to make his own examinations. All agree, however, that better facilities for the printing, indexing, and access to existing patents should be provided.

The diverse workings of the system of official examinations is shown in Prussia, where almost every application for patents is rejected, and in the United States, where four fifths of all applications are finally granted. In both of these countries, especially in the United States, in addition to court trials, a vast amount of litigation attends these official examinations at the Patent Office, which is almost unknown in England.

We give, on another page, as an example of the current patent law discussions now going on in England by the ablest minds, an abstract of the recent proceedings of the Institution of Mechanical Engineers on the subject.

CENTENNIAL TRADE MARKS.

As the time approaches for the opening of the great Centennial Anniversary and Exposition, the word "Centennial" becomes more and more familiar and popular in the public mind; hence it has become a favorite stamp for trade goods of almost every description. "Centennial" hats, caps, gloves, brushes, "Centennial" this, that, and the other, are all the rage now; and quite a little rush has been going on at the Patent Office for several months past, for registration of these Centennial trade marks.

The Patent Office has sought to gratify and satisfy the applicants by allowing registration in every case where it had not been previously granted for the same class of goods or articles. But it would appear that such registrations are not likely to be sustained, in any broad sense, by the Courts.

In the United States Circuit Court at Philadelphia, recently, there came up the case of Hartell *vs.* Viney. In the bill of complaint, in which the court was asked to restrain the defendants from the use of a design of the Centennial buildings on medals and the use of the word "Centennial," it was argued that, though the design upon the medals manufactured by the defendants was not an exact copy of the one used by the complainants, it bore so close a resemblance to it as to deceive the public, and that the use of the word "Centennial" was a clear violation of the law of trade marks.

The judge refused to grant the injunction. He said there were two questions to be determined—first, as to the patented design of the complainants and the effect of the two patents. The former had not been copied, but defendants had merely used one of a similar kind. In doing so, there had been no abridgment of their labor and no appropriation of the subject matter.

In considering the second question, that of the trade mark, the judge did not think the word "Centennial" could be appropriated by any person or association exclusively. It had been applied to works of art for several years, and had been used in the public laws of the United States since 1871. It had been applied to lager beer, to fancy soaps and fancy clothing, and to an infinite number of articles, ornamental and useful. A word of such general use and of so common application could not be the exclusive property of any one. And in the use of such as a trade mark, no court of equity would afford a remedy against a person who had appropriated it.

It has all along been held that no person was entitled to the exclusive use, as a trade mark, of the mere name of a well known article of trade. For example, no hatter could register, as his exclusive mark, the word "hat." The present decision places the word "Centennial" in the same category, and declares that this word cannot, of itself, become a lawful trade mark: and therefore the registration of combined words, such as "Centennial hat," will not prevent others from using the same words upon similar goods.

In order to secure an exclusive right, in connection with the word "Centennial," it will be necessary for the applicant for registration to add a new pictorial device, or some new and distinctive word or title, to be used in connection with the word "Centennial." The following is the statute upon the subject, section 79, law of 1870:

The Commissioner of Patents shall not receive and record any proposed trade mark which is not and cannot become a lawful trade mark, or which is merely the name of a person, firm, or corporation only, unaccompanied by a mark sufficient to distinguish it from the same name when used by other persons, or which is identical with the trade mark appropriate to the same class of merchandise and belonging to a different owner, and already registered or received for registration, or which so nearly resembles such last-mentioned trade mark as to be likely to deceive the public: Provided, that this section shall not prevent the registry of any lawful trade mark rightfully used at the time of the passage of this act.

THE DIFFERENCE BETWEEN WATER AND NITROGLYCERIN.

One of our correspondents, writing to us in advocacy of the possible truth of the Keely motor deception, bases his conclusions upon the following premises:

"We know that there is an enormous power stored up in nitroglycerin, which may be liberated by a small mechanical force. We know that there is a similar power in water; and because we have never discovered a mechanical means of liberating it, it does not necessarily follow that it cannot be done."

Now the fact is that we know there is not a similar power in water, because water is water, and it is not nitroglycerin, nor anything equivalent to it. Nitroglycerin consists of unburnt carbon and unburnt hydrogen, with oxygen enough to burn it up, which oxygen is loosely held by the nitrogen; the latter is ready to give up or let loose its oxygen on the least cause being given, such as a jar or a blow, when at once it is taken hold of by the carbon and hydrogen, which are then as rapidly, and even more rapidly, burnt than the carbon and sulphur in gunpowder, which also find the oxygen needed for their combustion in the niter mixed with them. It is in these cases the combustion of the nitroglycerin and of the gunpowder, and not so much their expansion by the enormous heat produced, which is the cause of their power. This is proved by the explosion of the mixture of two volumes of hydrogen gas with one volume of oxygen; the result of the combustion, watery vapor, has a volume ⅓ less than the mixture, and the water produced by its condensation a volume of some 500 or 600 times less; but the temperature developed, that of the oxyhydrogen blowpipe, is one of the highest we are able to produce, and this heat it is which expands the gases so enormously that a soap bubble, filled with this mixture and touched by a flame, explodes with a report like that of a pistol. The result of the explosion is a few drops of water. Water is thus the product of the combustion of hydrogen; in other words, it is burnt up hydrogen, which lost its latent energy at that early period of the earth's formation when all the free hydrogen was burnt up into water. To suppose that water could again develop so much energy is equivalent to attempting to burn the ashes of wood, the cinders of coal, the vapor of gunpowder or of the exploded nitroglycerin, over again. The products of the combustion of the latter substance are mainly water and carbonic acid, and there is the end of it.

Any one who possesses a little knowledge of the elementary principles of chemistry knows that water and air consist mainly of three gases, oxygen, hydrogen, and nitrogen, with a small amount of carbonic acid; he knows that the most learned chemists, men devoting their whole lives to the science, have during a century exhausted their ingenuity and patience to study the properties of these elements and their possible combinations, so that at last these have become parts of the most positive science. Therefore, such startling announcements as of a gas with a volume 500,000 times greater than water, as have been made by Mr. Keely, can, by any person possessing the least information, be only received with serious suspicion.

THE USE OF WIRE IN DEEP SEA SOUNDINGS.

The advantages of wire for deep sea sounding are many and great. Not the least of its merits, compared with rope, are the smallness of its area for the required strength and the smoothness of its surface. By the use of wire, too, the need of cumbrous and expensive apparatus for casting and hauling-in is avoided, and also the loss of three or four hundred pounds of lead at every casting. With rope the work is more difficult and tedious, and less sure at 500 fathoms than at 2,000 with wire. With rope, used in the ordinary way, six men have a heavy haul to bring up the lead in soundings of fifty to sixty fathoms when the ship is under way. By the wire process, a cabin boy can bring up a 34 pound sinker with ease, from the depth of an hundred and fifty fathoms, with the ship going on her course from four or five knots up to full speed. Presenting a smaller surface to the water, the wire is less affected by currents, a lighter sinker can be used, and it is possible to reach the bottom in many cases where sounding by the old method would be impossible. The first experiments with wire were failures, owing to the weakness of the splices made. Though the splice might hold, the stiffening of the wire by the solder used made the joint treacherous, the wire snapping at the edge of the solder. It was sought to obviate this difficulty by using a sounding wire drawn in one piece, and a company in Manchester, England, succeeded in producing for Sir William Thomson a length of crucible steel wire three nautical miles long without a splice. But it was found impossible to make such wire of uniform strength. It would have weak spots, and was liable to kink and snap like packthread. At last Sir William hit upon the happy device of making a strong splice by a long succession of weak and somewhat flexible fastenings, which enabled him to use pianoforte wire, in lengths of two hundred yards. The size employed is No. 22 Birmingham gage, weight 14½ pounds to the nautical mile, and strength exceeding a strain of 240 pounds.

By the use of an auxiliary hauling-in apparatus, it was found possible to avoid the crushing strain on the formerly used apparatus, which made it necessary to abandon the sinker every time a deep sounding was made—a great item in the cost of such observations. Now the sinker can be recovered from depths not exceeding 3,000 or 3,500 fathoms under ordinary favorable circumstances. Where the depth exceeds 4,000 fathoms, a 100 pound sinker is used, with trigger apparatus for detaching it when it reaches the bottom. For depths of 3,000 fathoms or less, a 30 or 35 pound sinker without detaching apparatus is preferred.

Using these improvements, it is also found easy to take soundings of 2,000 or 3000 fathoms from a sailing vessel hove to in moderate weather, that is, hove to while the line is running out, and until a few hundred fathoms of wire have been hauled in. When the length out does not exceed 2,500 fathoms, the ship may be driven ahead slowly with gradually increasing speed, rising to five or six knots when 1,500 fathoms are out, and to ten or twelve knots while the last 500 fathoms are being raised. Thus a great saving of time is made; for in the ordinary process with hemp cord, the ship has to lay to while all but a few hundred fathoms have been brought in. The only failures in sounding with pianoforte wire have been owing to a neglect of applying a sufficient resistance to the paying out wheel to balance the weight of wire out.

With a 34 pound sinker. it takes about thirty minutes to reach a depth of 2,000 fathoms. Where greater expedition is required, a heavier sinker is used. A 34 pound sinker can be brought up from 2,000 fathoms in about fifteen minutes, making forty-five minutes for the sounding. But the detention is less than this, since the greater part of the line can be hauled in while the ship is proceeding on her course. Using a 150 pound sinker, without recovery, the sounding can be made at 2,000 fathoms with only about twenty minutes' detention. Soundings of 1,000 or 1,500 fathoms with a 34 pound sinker require a stoppage of twenty minutes while the lead is going down, the ship going ahead at full speed as soon as the lead strikes the bottom.

By a properly planned brake resistance, it is arranged that, as the weight nears the bottom, there is an increasing resistance to its motion, so that the paying out wheel stops promptly; there is no coiling of the wire on the bottom, and no danger of kinks. Even at so great a depth as 4,000 fathoms, the perception of the bottom is instantaneous.

Complaining of the indifference of the British Admiralty to this improved method of sounding, as manifested by their holding to the old cumbrous and tedious method, even in the fitting out of a vessel like the Challenger, Sir William Thomson pays a high compliment to American naval officers. He says:

"They found my apparatus full of defects. They never asked me to perfect it, but they perfected it in their own way and obtained excellent results. [Witness Commander Belknap's soundings in the North Pacific.] I went on independently in another line, and made a considerably different apparatus from that which is now being used by the Americans; but I was very much struck by the great zeal and the great ability which the American naval officers showed in taking up a thing of this description, which had been merely proved to be good, and charged themselves with improving the details and making it a workable process."

To keep the wire from rusting when not in use, Commander Belknap immersed it in oil. The English use a solution of caustic soda, which prevents rusting well enough, but has the bad effect of corroding the solder of the splices.

The Rumored Death of Donaldson the Aeronaut.

Mr. Washington A. Donaldson and a reporter of a daily journal in Chicago started on a balloon trip from that city several days ago. Nothing has since been heard from them, and the fact of their balloon having taken a course directly over Lake Michigan, and probably encountered a severe storm which arose shortly after their departure, is taken as basis for the supposition that both the daring aeronaut and his companion have perished. Captains of vessels report sighting the air ship, with its car dragging in the lake; but as yet there are no tidings of any portion of the balloon nor of the bodies of the men being found. We should regret exceedingly to learn of Mr. Donaldson's death, for, though rash even to foolhardiness, he was one of the most experienced and skillful aeronauts living, and an inventor of no small genius. For the present, we prefer to believe in his safety, and to cling to our first suspicion that the affair is another of those shrewd advertising dodges for which Mr. P. T. Barnum, with whose show Donaldson was connected, is famed.

Grass Planted by Grasshoppers.

A curious fact connected with the grasshopper raid in Western Missouri is that, wherever pastures have been destroyed by the insects, new varieties of grass, which never before have been seen in the localities, have sprung up. The principal species is a green bunch grass of luxuriant growth, covering ground formerly yielding nothing but blue grass. Cattle eat the new species with avidity. It is conjectured that the seed was brought to the region and deposited by the grasshopper swarm which laid their eggs there last fall. Some definite explanation of the phenomenon would be very interesting, since it is not known where the grass originally grew or what may be expected of it, if its growth continues, in the future. Possibly the grasshoppers may prove a blessing yet.

The Electrical News.

This is the title of a new weekly periodical published in London, under the editorship of Professor William Crookes. Its programme of contents is intended to embrace all matters relating to the science of electricity, together with special reports of progress in the art of telegraphy and the various practical applications of electrical machinery. It is a handsomely printed publication, in magazine form, twelve pages. We welcome its advent, and wish for its success.

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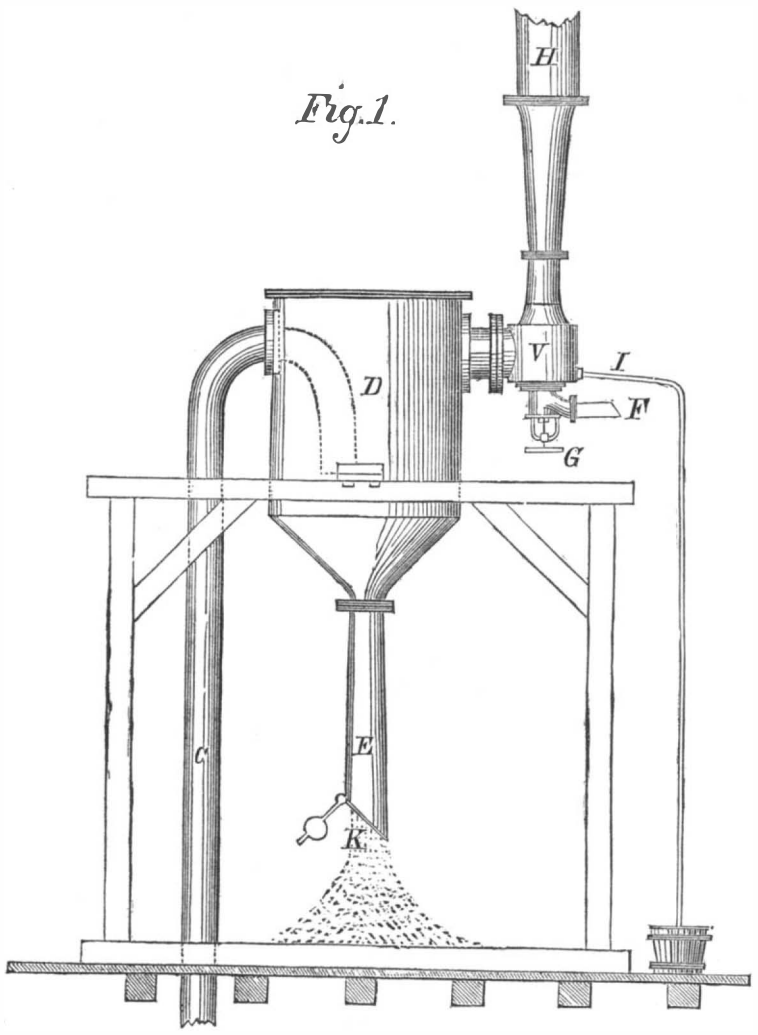
IMPROVED ELEVATOR FOR GRANULAR MATTERS.

Our illustrations show an ingenious adaptation of the injector principle to the elevation of corn and other granular material, utilizing the power of the steam directly, and saving the expense of the usual rotary mechanism. It is the invention of Messrs. Körting Brothers, of Hanover, Germany, whose improvements on the injector are too well known to need recapitulation here; and the inventors describe it as especially adapted for raising pulverized charcoal in sugar refineries, but the adaptability of the principle to our grain elevators is sufficiently obvious.

An hermetically closed receptacle, D, is supported above the point to which the charcoal is to be raised, and a partial vacuum of greater or less pressure is created therein by a steam exhauster, V. The receptacle, D, is connected by a suction tube, C, with the suction base, A, Fig. 3, which takes up (by a bottom opening, O, and a suction opening, B) the air, and carries it in upward direction with a velocity corresponding to the force of the vacuum created in the receptacle. The current of air acts on the charcoal entering through the funnel-shaped part, A, Fig. 3, of the suction base, and carries the same, through the suction tube, C, upward into receptacle, D, where the charcoal, owing to the reduced velocity of the air in the larger receptacle, falls by gravity, and the air is drawn off through the exhauster. The exit tube, E, extends from the bottom of the receptacle, D, to the point of discharge, and has an automatically working valve, K, which is opened by the weight of the charcoal in the discharge tube. The tube, E, must be of such a length that the body of charcoal in it when the valve, K, is opened will be of sufficient thickness to prevent the air from entering the receptacle, and therefore the exhaust air will be compelled to pass through the suction base, and be available for for raising the material. A funnel below the discharge valve may be connected by a telescope tube with the filters, etc., to convey the charcoal directly to the point where it is required for use. The quantity of charcoal, etc., raised is regulated by the exhauster and the adjustable base. No engine is required; and as a steam pipe is all that is necessary to work the elevator, the apparatus may be erected at any point in a factory. The construction is simple; and the elevator needs hardly any repairs, and is always ready for use. Moreover it does not pulverize the charcoal, a fault common to the various belt and bucket elevators,and one that occasions considerable loss.

Fig. 1.



KORTING'S ELEVATOR.

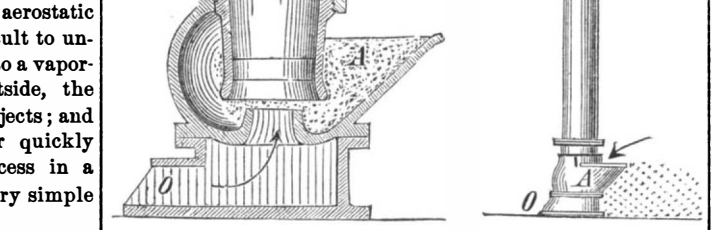
FROZEN WATER IN BOTTLES.

Visitors to Paris are well acquainted with the glass bottles containing water frozen into solid blocks which are delivered every morning by *La Société des Carafons Frappés* to its customers; and the country cousin wonders indefinitely as to how the block of ice is put into the bottle. A new method of congeling such bottles of water has recently been introduced by M. Carré, an inventor whose success in the introduction of freezing machinery is well known.

Freezing water in a vacuum is a common lecture room experiment, and it is readily done by placing water in a saucer under the bell glass of an air pump, and exhausting the air; when the ebullition caused by the withdrawal of the aerostatic pressure ceases, congelation begins. It is not difficult to understand the sequence. In passing from a liquid to a vaporous condition, without the aid of heat from outside, the water must borrow some heat from surrounding objects; and this heat passing off in vapor, the remaining water quickly becomes frozen. M. Carré has utilized this process in a very ingenious manner, and has reduced it to a very simple and economical method, capable of domestic use.

The bottle is suspended, by means of a rubber cork, from the nozzle of a pipe, as shown in our engraving; and the withdrawal of the air, by working the hand lever, induces a speedy commencement of ebullition. The rising vapor is drawn through an intermediate vessel filled with sulphuric acid, which at once absorbs and condenses it, and congelation commences in the middle of the water in the bottle; and from the first formed particles,needles of ice soon radiate in every direction. Their number augments in geometrical progression, and their size increases as you behold them, until, in less than one minute from the commencement of the operation, a bottle of water (a liter, four fifths of a quart) is frozen solid with very little exertion.

This seems to be a handy apparatus for use in places where ice is not readily obtainable; and the only inconvenience in its use is the presence of sulphuric acid, which in this relation soon becomes diluted till it is inefficient for its purpose. But it does not seem to be difficult to render the dilute acid marketable, and the attention of chemists may well be turned in this direction. It seems that the hard treatment which the public in some places has for many years suffered at the hands of ice companies may soon be avenged. Ice is now being made and sold in London for 10s. ($2.50) per tun; and if a more simple method of doing this can be introduced, so that the indispensable commodity may be made in every grocery or household, the storing companies, with their huge monopoly, their cumbrous carts,and their high charges (owing partially to risk of storing too much, to the great waste, and to interest on money sunk in the process), may soon be gone from among us.



CARRE'S FREEZING APPARATUS.

Lead and Tin Foil.

Many metals and alloys can be hammered or rolled into thin sheets, and in this operation the ordinary molecular structure, which they have when cast, is changed, and they become more dense. Among these metals are gold, silver, copper, tin, platinum, lead, zinc, aluminum, iron, nickel, and their alloys; other metals are not malleable but brittle, and cannot be rolled or hammered out alone, nor drawn into wire.

Fig. 2.

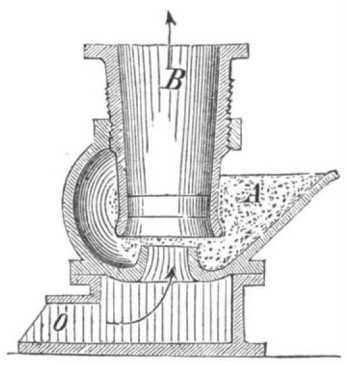
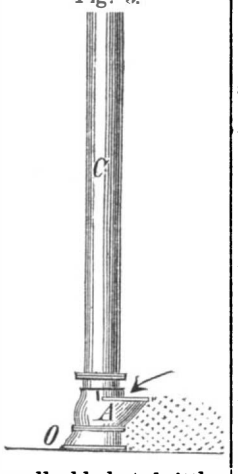


Fig. 3.



Beside the noble metals, which were used by the oldest civilized nations, bronze (an alloy of copper and tin) was also employed by the ancients for useful utensils, for at the present day a glance at Pompeii teaches us how extraordinarily artistic and neat were the water vessels, stands, and holders of all kinds, as well as the water spouts adorned with bronze figures. We know that the Romans, and perhaps the Phœnicians, obtained their tin from England. But the common metals then known, like copper, tin, lead, and iron, were not prepared in such large quantities,and consequently must have then represented a much higher relative value than now.

Lead, which occurs in Nature, for the greater part,in combination with sulphur only,as sulphide of lead (galena), is the easiest of all metals to reduce from its ores, being obtained at a comparatively low point of fusion. For this reason, as well as on account of the frequent deposits of lead are in the old world,especially in Greece,Sardinia, and Spain, civilized nations employed metallic lead extensively for pipes and in sheets. In almost every house newly excavated in Pompeii, there may be seen the thick cast lead pipes, with the names of different firms and the place of manufacture cast upon them. These antiquities are chiefly preserved in the museum at Naples. Not only Rome and Greece made use of this easily fusible metal, but even the still older nations of India and China possessed, and still possess at the present time, great skill in smelting lead and tin. Proofs of this are the well known genuine tea chests which are lined with lead, packed, and soldered up in China for shipment.

The Chinese employ an alloy of lead with some tin and copper to prepare metallic foil as thin as paper, in which large lots of tightly pressed tea are packed and shipped to all parts of the globe. The fusible alloy is melted and poured on a smooth stone; and as the mass solidifies slowly, because the amount of heat for fusing can only be small, the Chinese workman has time enough to throw a second smooth stone upon the still liquid mass, and finally, in primitive style, jump upon it so as to increase the pressure. The Chinese people are so extraordinarily conservative in their customs that we cannot expect that this method of making sheet lead will suffer any advance by the introduction of rolling or hammering. In Europe especially in Germany,it is not so very long since men were obliged to work with very limited aids. Then there sprang up in Venice, and afterwards in Nuremberg, the mirror makers, who employed their tin foil with mercury for covering the glass plates.

A mirror of the size that we are accustomed to have now could not be obtained in the last century, because the sheets of tin foil were not large enough to make them; besides, the wide cylinders for mirror glass could not then be made.

The demand for larger sheets of metal was satisfied gradually by the progress and extension of machine building, although large plates of copper, tin, and iron had already been hammered out with great skill. A few decades ago snuff was packed in rolled lead foil, but this has been prohibited for a long time. In its place has appeared pure tin foil, which is quite cheap on account of its great thinness and small specific gravity. By reason of its manufacture in larger quantities and new discoveries of tin ore in Australia, the price of tin foil has fallen to one half its previous price.

Tin foil is chiefly used for a reliable airtight covering. Like the well known tin boxes used for preserving food on a sea voyage, so wrapping an article in tin foil protects it from the external air so that it does not decay. Extract of meat, sausage, cheese, etc., are protected in this way.

On the other hand, tin foil prevents evaporation and drying, as of snuff, wine,liqueurs,bouquets of flowers,etc. The airtight metallic wrapper preserves the costly odors and perfumes of many fine articles, as chocolate, fine cigars, vanilla, cosmetics; there is in fact no more reliable protection against the volatilization of valuable odorous substances than the non-poisonous metallic foil referred to. Not only isthis object accomplished,but with it are combined neatness and elegance, the useful and the agreeable, since the silver-white, polished, and mirror-like shining metal makes a better impression of neatness than any other envelope for a commercial article. This exterior at once adorns the contents and indicates their high value.—*A. Andersohn.*

PIG IRON IN THE UNITED STATES.—The production of pig iron in the United States last year amounted to 2,689,413 tuns, as compared with 2,868,278 tuns in 1873, and 2,854,558 tuns in 1872. The following States made more iron in 1874 than in 1873: Maine, Vermont, Massachusetts,New York,Virginia, Georgia, Alabama, Texas, West Virginia, Tennessee, Ohio, and Michigan. The following States made less iron in 1874 than in 1873: Connecticut, New Jersey, Pennsylvania, Maryland, North Carolina, Kentucky, Indiana, Illinois, Wisconsin, and Missouri. The greatest increase in 1874 occurred in the miscellaneous bituminous coal and coke district in Ohio; the greatest decrease in 1874 took place in Lehigh, Pa.

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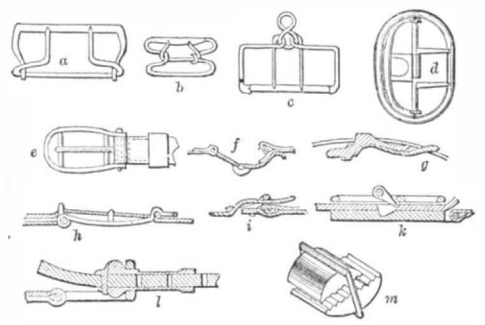
FASTENINGS.

We extract from Mr. E. H. Knight's "American Mechanical Dictionary" the following illustrations and descriptions of various forms of fastenings, including buckles, bag fasteners, belt couplings, bale ties, and broom heads. In connection with the belt couplings, we add descriptions of a few other devices relating to belting.

BUCKLES

are divided into bar buckles and roller buckles, the only difference being that the latter have a thin metallic tube around the bar opposite the tongue which, by its revolution, facilitates the passage of the strap. *a*, Fig. 1, has a wire passed through the ends of the loop, and bent ends to form tongues

Fig. 1.



Buckles.

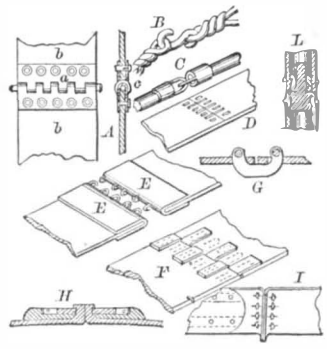
b has a bent wire embracing the waist of the loop. In *c* the recurved ends of the loop form the tongue. *d* has a tongue and pressure bar on one crossbar. *e* is a tug buckle. *f* is a buckle in which the strap is pinched between a pivoted bar and the lip of the frame. In *g* the strap is held between the two parts of the frame, which are pivoted together. *h* has a number of projections which fit corresponding holes in the strap. *i* is a skate strap buckle, in which the tongue can be loosened from the strap by lifting the rear end of the buckle. *k* is a tug buckle, in which the tongue is vibrated by means of a cam, *l* has a pair of metallic jaws and a tongue extending across them, and *m* is composed of a pair of serrated faced blocks, which are brought together by the strain on the strap.

The commonest mode of connecting belts is by a lacing of leather. Many special devices have been contrived to dispense with this last. We give a variety of

BELT COUPLINGS

in Fig. 2. A represents a coupling in which the ends of the belt, *b*, are secured by eyelets or rivets between bent metallic straps, *a*, which form leaves of a hinge, *c*. A pintle passes through the eye of each portion of the hinge. For the round belts of foot and hand lathes, a figure-8 hook, B, is employed or a coupleof sockets, C, are used, into which the ends of the belt are inserted, and which have a hook and eye respectively. For flat belts in which lacing is not deemed advisable, the ends may be joined by hooks inserted from alternate sides and hammered flat, as at D. Other modes involve hooks, E, or lapping plates, F. Some have curved metal bars, G, slotted plate and toggle jaws, H, or rivets which pass through the out-turned end of the belt, as at I. L is a tie in which a plug with two grooves is made the means of connection; the belt is tubular and the respective ends are throttled by wires into the grooves of the plug.

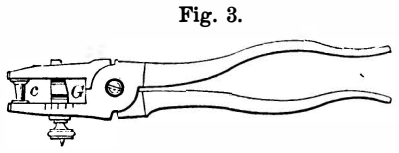
Fig. 2.



Belt-Coupling.

Fig. 3 is a simple instrument for preparing belts for being laced and coupled. It forms the holes for the clasps or lacing by means of a punch, *c*, which acts against an anvil on the other jaw. The latter is graduated and has an adjustable gage, G, which may be set at such a distance from the nose of the pliers that a row of holes may be readily punched at a set distance from the edge of the belt.

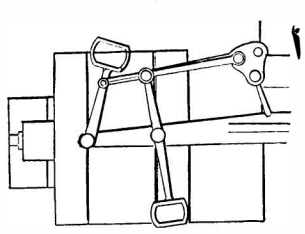
Fig. 3.



Belt-Punch.

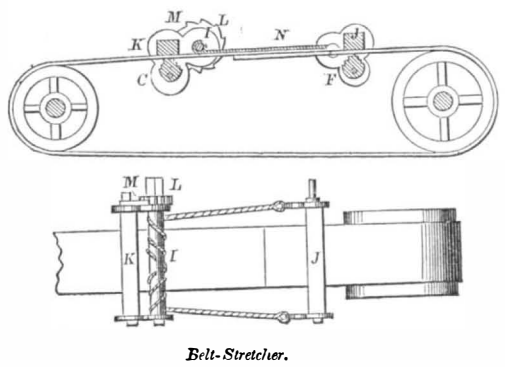
Fig. 4 is a belt shifter for moving a belt from a fast to a loose pulley, and *vice versâ*. The pivoted levers, connected by jointed rods with the rocking bar, simultaneously shift the belts. For drawing together the ends of a belt, in order that they may be connected, the apparatus shown in Fig. 5 is used. The belt is placed around a couple of pulleys and the end lapped. The stretcher consists of a pair of clamps, K C, J F, and a tightening cord, N, the leather in each clamp being pinched by a serrated eccentric. The rope winds upon the roller, I, the pawl, M, engaging the ratchet, L, to maintain the stretch.

Fig. 4.



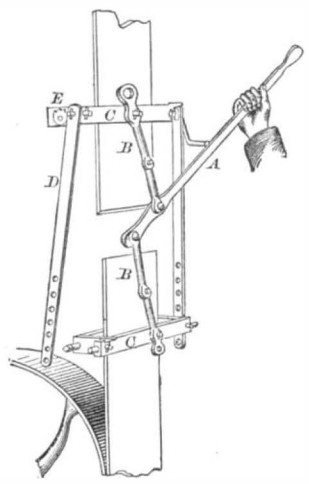
Belt-Shifter.

Fig. 5.



Belt-Stretcher.

Fig. 6.



Belt-Tightener.

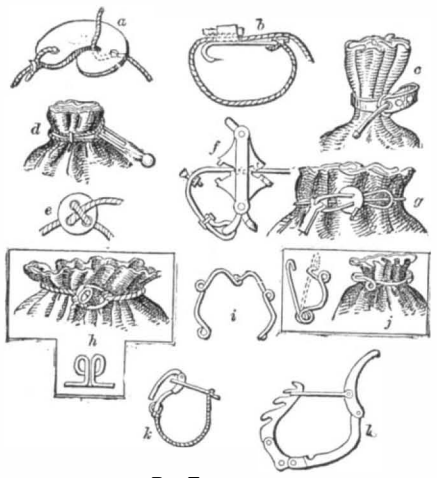
Fig. 6 shows a double clamp and a tightening device, in which A represents a lever acting through toggles, B, to draw the clamps, C, toward each other. When the latter are carried as nearly together as may be requisite, they are held by the link, D, until the belt is connected.

A variety of different forms of

BAG FASTENERS,

used for securing the mouths of bags below the hem, are represented in Fig. 7. In *a* a sheet metal tag with a curved tapering slot is permanently attached to one end of the string; the other end of the string becomes jammed in the slot. In *b* the metallic tag attached to one end of the string has a thimble in which the other end of the string is jammed by a wedge. One end of the string in *c* has a permanent ring. The other end is rove through an eyelet in itself and jams against the ring. *d* shows one loop permanently attached to a slotted lever. The latter is passed through the other loop and turned over beyond the dead center so as to jam the loop against the standing part. In *e* the standing end is rove through two holes in the tag, and forms a loop which jams down upon the point end of the cord. The point end, in *f*, is jammed between two pivoted cogged sectors. In *g* the perforated leather tag is riveted to the bag and the thong is rove through the holes so as to bind tightly. *h* shows one end of the cord knotted to the loop of the wire. The other end is passed round the bag and jammed between the jaws. A pair of hinged clasps

Fig. 7.



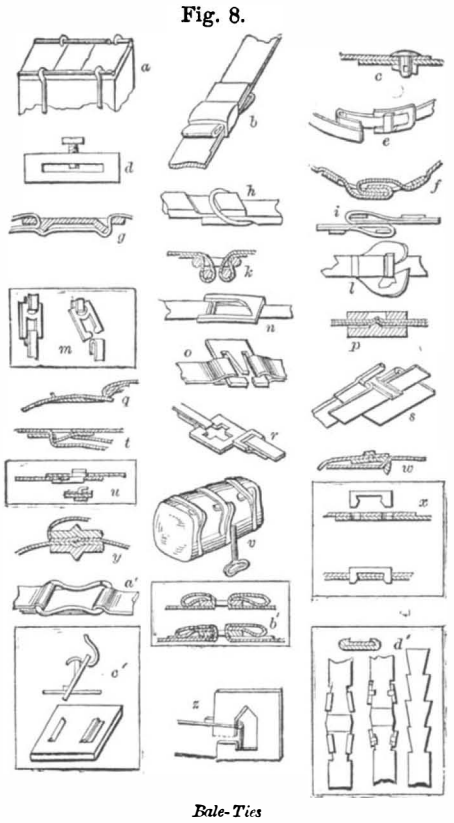
Bag-Fasteners.

is represented in *i*, the free ends of which interlock. *j* is a spring device acting in the manner of a brooch, a spring pin engaging the catch. In *k* a lever attached to one end of the cord engages a loop on the other end, and is thrown over to carry the loop to a curved portion, which holds it securely. *l* is similar to the last, but has a means of adjustment.

In Fig. 8 a large number of bale ties are represented, their use being to fasten the ends of the hoops by which bales of cotton are held in compact form. *a* is a simple arrangement of hooked bars. *b* shows the strap ends bent and inclosed in a collar. *c* is a rivet, and *d* a set screw, and *e* a species of buckle. In *g* the hoops are passed through slots in a separate piece, and bent over so as to become jammed. *g* is a device of the same kind, somewhat simpler in construction. In *h* a ring engages in notches made on the sides of the bands. *i*, *k*, and *l* are locking devices readily understood from the diagrams. *m*, *n*, *o*, *r*, and *s* all involve separate catch pieces, in notches or slots in which the straps engage. *p* and *y* resemble each other in that the straps are jammed between the portions of a kind of buckle. The other devices need no especial description.

In connection with the subject of ties for bales may be mentioned the devices for baling cut hay, and for baling feed and forage rations, to condense their bulk for transportation. One plan briefly is as follows: The hay is carried by an endless apron to a rotary cutter, which, cutting past a fixed blade, chops the hay into pieces. A winnowing apparatus then removes the dirt from the material, and finally crushing rollers render it soft and flexible. In this condition the hay is placed in a strong press and readily compressed into a solid mass. In baling forage rations, a feed of corn is placed in a feed of hay, and the whole is condensed into the shape of a large brick.

Fig. 8.

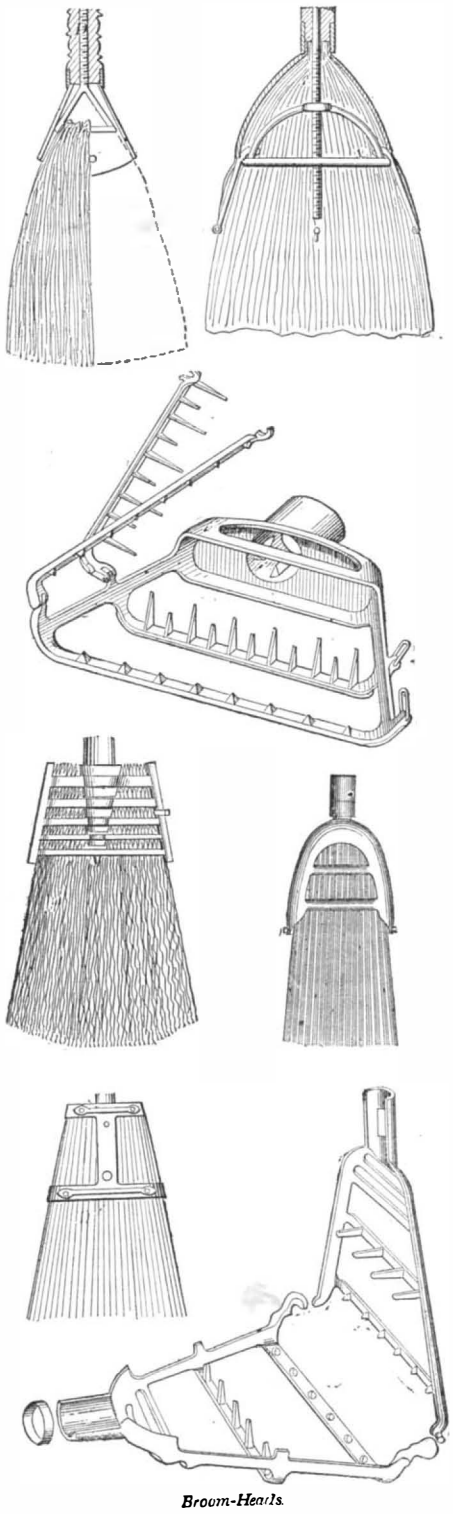


Bale-Ties

BROOM HEADS,

such are shown in Fig. 9, are clasps or caps for holding the bunch of broom corn so that a worn stump may be removed and fresh brush substituted. In the upper left hand example, the straw is hung over the stirrup and drawn into the cap by the screwing of the stirrup into the handle. The next

Fig. 9.



Broom-Heads.

figure shows another stirrup, screw shank, and cap arrangement. The figure beneath has a head, the bars of which have prongs to enter the bunches of straw. The bars of one side open to admit the corn, and are then locked in closed po-

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sition. The following examples have variously shaped heads and modes of securing the contents. The lower figure has a clasp, with a pair of hinged jaws with pronged bars.

Correspondence.

On Ponderable Matter and the Ether.

To the Editor of the Scientific American:

No intelligent student of Science can help being struck with the violations of the first principles of mechanical philosophy in the current conceptions of ether and dense matter, and which the highest authorities do not know how to avoid. To blind ourselves to them must necessarily vitiate all our conclusions in regard to the constitution of Nature. I therefore wish to draw attention to the most prominent objections, in reply to which there has been nothing at all satisfactory.

Let us assume the ether to be continuous, which, consistently with the principles of thermodynamics, we must; for were it particled, heat would be taken up by it, and an equilibrium of temperature with the bodies it surrounds attained, instead of being, as it evidently is, a cold medium of radiation. Then solid atoms moving through it must displace their own bulk, and lose force of motion according to the resistance; and equably, whether a body be rare or dense, unless the body as a whole displaces the ether bulk for bulk, which is negatived by aberration. Besides, according to the laws of fluid resistance, all bodies removing within the ether would be resisted according to the squares of their velocities; and the ether within the interiors of bodies should offer resistance as the velocities (squared) of the molecules. The nearer that planets are to the sun, a greater resistance to their motion should therefore be manifested, their motive forces being proportionally greater. Indeed, many have argued with great force (see Bayma's "Molecular Mechanics," pp. 27 to 31) that motion is impossible if matter be continuous. Bayma himself, however, has to make the ether virtually continuous, or self-attractive, in order to attempt to explain the unresisted motions of the heavenly bodies. Another objection to the continuity of the ether has been the proof that, in a continuous fluid medium, all transversal waves must become changed to longitudinal at a great distance from the point of propagation, which the phenomena of light shows us to be not the case.

The matter is not mended by supposing the ether particled, and ascribing definite intervals between the particles; while to suit the phenomena of light, the ether must be understood to possess the properties of an elastic solid. Although the difficulties attending the explanation of dispersion, and transversal vibrations to any distance, are not so formidable, others as great are made, while the objections already indicated in regard to resistance to bodily motion still remain. No matter to what extent the distances of the ethereal particles may be conceived, proportional forces of repulsion must be assumed to hold them in their respective places, and proportional pressure against gross matter in motion. We need not dwell upon the metaphysical difficulties involved in making space both a plenum and a vacuum for the swinging of ethereal particles, the mathematical quantities of nothingness being vastly greater than those of substance.

"Astronomy says aberration cannot be explained unless the ether be at rest; Optics replies that refraction cannot be explained unless the ether moves," are Professor Lovering's words. Tyndall is self-contradictory. The ether "fills space; it surrounds the atoms of bodies; it extends without solution of continuity through the humors of the eye." "The intensity of the light depends on the distance to which the ether particles move to and fro." ("Notes on Light," pp. 218—220.) He does not say whether the ether particles which do *not* fill space strike against each other or not. If they do, they have only a certain amount of space to swing in. If they do not, we are thrown back again upon the generally repudiated theory of action at a distance. Herschel seemed to favor the idea of making the ether self-attractive, but attached beyond the known limits of space, so that it would be virtually in a state of tension, and all wave motion be consequently transversal to the direction of propagation. Others make it self-repellent as well as of great tenuity, to allow the heavenly bodies to pass through it free from the resistance of aggregated particles.

In the ether has also been sought the cause of cosmical motion. Professor Challis supposes a force of impulsion from outside the limits of the stellar universe, and all radiant waves the result of material reaction in a continuous ether. The gravity waves are constant, and proportional to mass; and yet, at the same time, other ever-changing, uninterfering waves are produced from the same bodies, with the alteration of material constitution and conditions! Besides, the difficulty of constant tangential motion is untouched, and the change from waves of attraction to waves of repulsion is assumed in interstellar regions where there is no evidence of such, in order to explain the stability of the Universe. Dr. Guyot, a predecessor of Challis in this line of investigation, opined that the ether became rarefied in dense bodies, the outside ether pressing thereto, like atmospheric pressure upon an exhausted receiver. But this opinion is shown by optical phenomena to be the converse of the truth. Maxwell sought in the ether the mechanical cause of gravitation, but was obliged to confess that he could not conceive of a medium, of which a diminution of intrinsic energy would be so far produced, by the presence of dense bodies, as to result in their mutual attraction, and at the same time be consistent with manifested radiant action. The theory of gravitation by impact, proposed by Le Sage, even as improved by Sir William Thomson, is altogether too artificial to be seriously held for a moment as being the reality, although it attempts to dispense with the ether as the cause of gravity.

Now is it possible to rescue Science from all this serious entanglement—to have a point of view whence a physical cause of the motion of cosmical bodies can be shown upon strict mechanical principles, and the ether producing such motion consistent with all other phenomena, collateral or otherwise? Whatever is true as a matter of fact may certainly be known, if we get upon the right track. In another communication, I will endeavor to point out the direction.

Philadelphia, Pa. WILLIAM DENOVAN.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXVIII.

DRILLING HARD METALS.

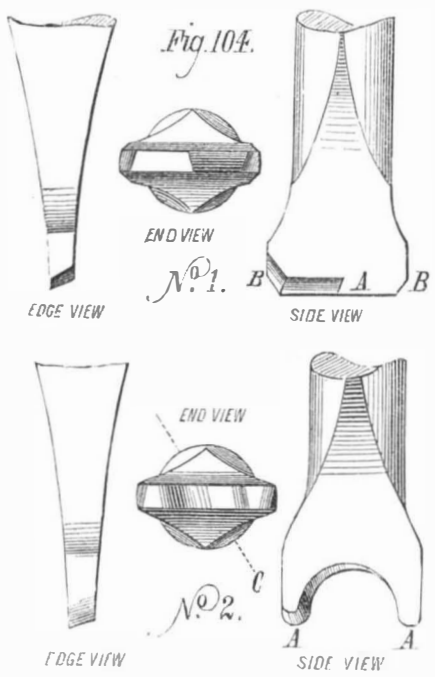
Very hard metal, such as steel tempered to a blue, may be drilled by a drill tempered to a deep straw color, the drill being used at a comparatively slow speed, and forced against the work as hard as possible without breaking the point of the drill. Sufficient oil may be applied, after the point of the drill has entered the metal, to keep the cutting edges barely moist, the drill being again allowed to run dry and again moistened, thus using as small an amount of oil as is consist ent with keeping the drill cool. In this way the drill will cut hard steel the best. For cast iron, however, the drill should be kept as dry as possible. In drilling cast iron that is very hard, and also wrought iron that has been casehardened, the operation may be greatly assisted by taking a hammer and a chisel and jagging the surface of the metal, thus enabling the edges of the drill to bite it. If necessary, the chisel may be made very hard for this especial purpose.

To make a drill exceedingly hard to suit some especial case, it may be heated in a charcoal fire to a dull red heat, and quenched in mercury instead of water. Another method is to heat the drill to a red heat in molten lead, and then to drive it into a block of cold lead, striking successive blows lightly and quickly until the drill is sufficiently cool to permit of its being held in the hand. The cases, however, in which a drill is required to be so hard are exceedingly rare.

If a drill squeaks while being operated, it arises from one of two causes: Either the cutting edges are dull, and require grinding, or else the cuttings are binding in the holes. In the first case, immediate grinding is necessary; in the second, the drill should be withdrawn and the cuttings extracted. Twist drills will bring out most of the cuttings of themselves, but a piece of wire, spoonshaped at the end, is necessary when plain drills are used.

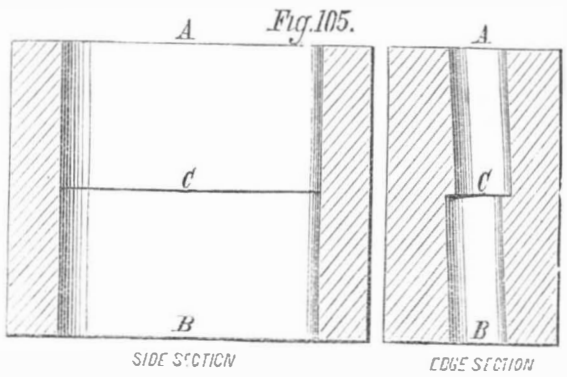
SLOTTING OR KEYWAY DRILLS.

For drilling out oblong holes, such as keyways, or for cutting out recesses such as are required to receive short feathers in shafts, the drill known as a slotting drill, shown in Fig. 104, is brought into requisition. No. 1 is the form in

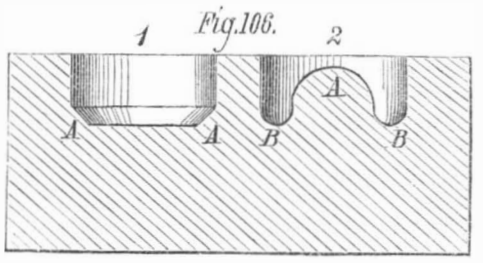


which this tool was employed in the early days of its introduction; it is the stronger form of the two, and will take the heaviest cut. The objection to it, however, is that, in cutting out deep slots, it is apt to drill out of true, the hole gradually running to one side. Suppose, for instance, as is sometimes the case, the slot or keyway is so deep that it becomes desirable to avoid having an extra long drill, which would be liable to bend and spring from the pressure of the cut, and hence that a shorter drill is used, drilling the keyway half way from each side: the tendency of such a drill would be to cut the slot as shown in Fig. 105.

The drill having entered at A on one side, and at B on the other side, and having cut down until it arrived at C, and hence cut the keyway clear through the metal, and the junction of the two not being even at C, it is evident that the keyway will require considerable filing to make the faces so true level, and parallel that the key will fit all the way through. To remedy this defect, the form of drill shown in No. 2 has been brought into use. It will be observed that it enters the metal at the points, A A, first, and therefore cuts a ring of metal out, leaving a projecting piece in the center which serves as a guide to steady it; whereas form No. 1 cuts a flat-bottomed hole. So that, if both drills were simply rotated and fed as a common drill, the holes made by them would appear as in Fig. 106. It will be observed that in No.



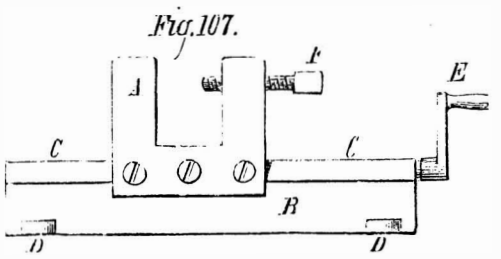
1 the beveled corners, A, alone steady the drill, while in No 2 there is the whole core, A, tending to steady it, in addition to the round corners, B B. These drills are, however, never used to bore round holes, but oblong ones only, which is accomplished by either causing the drill to travel back and forth to the required length of the hole, the work being held stationary, or else by revolving the drill in a stationary position, while the table to which the work is bolted travels back and forth to the requisite distance, the cut in either case being fed to the drill at each end of the travel. Thus a



slot, equal to the length of the travel of the work or the drill, as the case may be, and of a width equal to the diameter of the drill, is made. If drill No. 1 is employed to cut a recess, it will leave an angular corner, while No. 2 will of course leave a round one, the bottom of the recess in either case being left quite flat, since the bottom of No. 1 is flat of itself, while the rounded corner of No. 2 cuts away, as it travels along, the cone, A, which, as shown in Fig. 106, is made when neither the drill nor the work travels.

Slot drill No. 1 is made by filing the cutting end square, level, and true to the requisite diameter and shape, and then backing off, that is, filing away on one side, the edges from the center of the drill, outwards and across the beveled corner, as shown in Fig. 104; while No. 2 is made by filing up the cutting end true, level, and square, and then filing out the curved hollow centrally in the end face, with a round file held at an angle with the center line of the width of the drill, as shown by the dotted line, C, in the end view of No 2 in Fig. 104, after which the corners, A A, should be rounded and backed off. The thickness at the cutting end of drill No. 1 should be the same as that given for common drills, while No. 2 may be left somewhat thicker, to give it extra strength, since its form renders it comparatively weak. The reason for keeping the end of No. 1 as thin as a common drill is that it has, at the junction of its two cutting edges, centrally on the end face and between the beveled corners, a cutting edge across the thickness of the drill, as shown in end view, Fig. 104, and is in that respect subject to the defect before mentioned as inherent in common drills. This defect does not, however, exist in slotting drill No. 2, in which the cutting edges on the outside faces extend clear to the center of the diameter of the drill.

Slotting drills should be tempered to a deep brown, and should be supplied freely with oil when employed to cut wrought iron or steel, but must be kept perfectly dry when used upon cast iron or brass. They are revolved at a higher rate of speed than common drills. To employ them in a common drilling machine, whose table has no horizontal sliding motion, it is necessary to make a chuck which will bolt to the machine table; the chuck is to be provided with a pair of jaws to clamp the work, and to make the upper part of the chuck movable upon a slide in the lower part. Such a chuck is shown in Fig. 107, A being the jaws, wherein



to hold the work by means of the screws, F, of which there must be at least two, B being the bed, provided with the slide, C C, along which the head, A, is operated by means of the handle, E, which turns a screw running down the center of the slide and working in a nut attached to the center of the head, A. The lugs, D D, are provided with holes through which to bolt the bed to the drilling machine table.

In using such a chuck, the operator will be very apt to vary the distance to which he moves the slide at each cut, the effect of such variation being to cause the edge of the slot or keyway to be very uneven. To remedy this, it is best, after having drilled to the proper depth, to wind the slide and set the drill so that it takes a slight cut out of one

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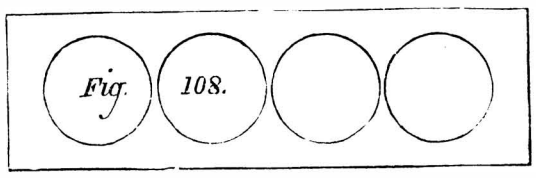
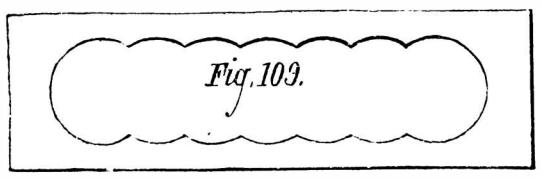
end of the slot at the top, and then (keeping the chuck stationary) to feed the drill down through the slot, thus cutting the end out quite even. In taking the first few cuts at the commencement of the operation, that is to say, immediately after the work is chucked, it is better to cut the slot a little less than the required breadth, so as to leave a little to come out of each end of the slot (as above described) to true it. It is obvious that parallel strips may be employed in the jaws, whereon to rest the work, or to make up the width between the ends of the screws, F, and the opposite jaw of the chuck.

There is probably no one cutting tool used in a machine which saves so much labor as the slotting drill, because it performs a duty that no other tool or machine can perform, and which is moreover a most difficult and tedious one. Before the advent of this tool, deep keyways were cut out of the solid metal in the following manner: First, plain holes were drilled through the work, as shown in Fig. 108, and



then these holes were plugged up by having pieces of round iron driven tightly in them. Then new holes were drilled, the center of each new hole being in the thin wall of solid metal between the plugged holes. After the latter holes were drilled, the remains of the plugs were driven out, when the keyway would present the appearance shown in Fig. 109. This entailed an almost incredible amount of chipping

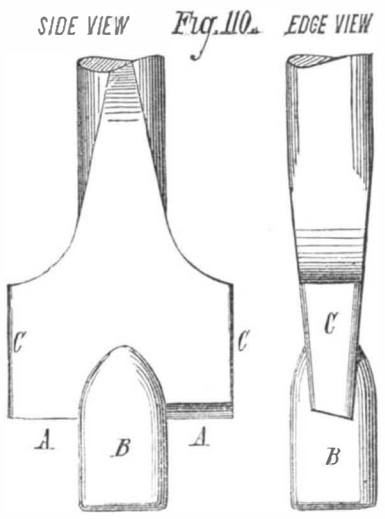


and filing in order to make the sides of the keyway level and true, and the width parallel. This method of procedure is, however, still in vogue to a slight extent, being confined mainly to jobbing and repair shops. It is also employed for very narrow and deep holes, since a slotting drill cannot be employed to advantage in holes of less than about $\frac{5}{16}$ of an inch in diameter, because of the bending and springing of the drill. If, however, twist drills are employed to drill the small holes, the plugging with pieces of iron may be dispensed with, for the reasons shown by Fig. 103 and its accompanying explanatory remarks.

It may here be observed that the principles of the action of the slot drill have been applied to a variety of purposes in woodworking, prominent among which is its use in Boult's paneling and dovetailing machine. In its adaptation to wood, as in its adaptation to iron, there is no other tool at all capable of performing the same kind of duty, irrespective of either time or quality.

PIN DRILLS.

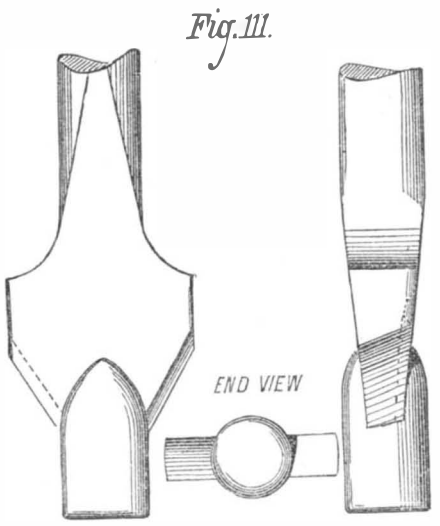
The next form in which the drill appears is the pin drill, which is a drill having a pin projecting beyond and between its cutting edges, as shown in Fig. 110, A A being the cut-



ting edges. The purpose of this drill is to face off the metal round the outside of holes, the pin, B, fitting into the hole so as to steady the drill and keep it true with the hole. In making this tool, the pin, B, the edges, C, and the ends forming the cutting edges, A A, should be turned up true in the lathe; the backing off may then be filed, leaving the cutting edges, A, with the turning marks barely effaced; thus they will be sure to be true and at an equal hight from the end of the pin, so that both the cutting edges will perform duty, and not one only, as would be otherwise the case. Pin drills should be tempered to a deep straw color, and run at a comparatively slow speed, using oil for wrought iron and steel, and running dry on cast iron and brass. In cases where, for want of an assortment of pin drills, there is none at hand with a pin suitable for the size of hole required to be faced, a drill having one too small for the hole may be made up to the required size by placing upon it a ring of iron or brass of the requisite thickness and about equal in depth to the pin.

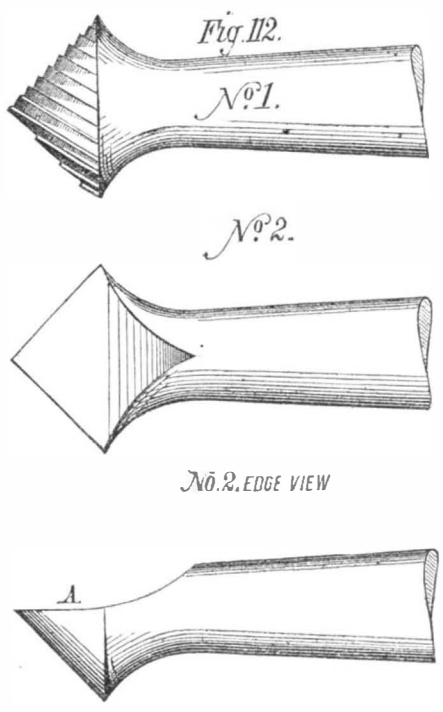
COUNTERSINK DRILLS.

Of countersinks, there are various forms; but before proceeding to describe them, it may be as well to observe that the pin drill described above may be employed as a flat bottomed countersink. Fig. 111 represents a taper countersink,



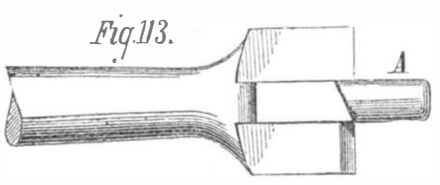
such as is employed for holes to receive flush rivets or countersunk head bolts, this form of tool being mainly employed for holes above $\frac{5}{16}$ of an inch in diameter, A A being in each case the cutting edge, and B, the pin. It should be made, tempered, and used as directed for pin drills. In tempering these tools, or any others having a pin or projection to serve as a guide in a hole, the tool should be hardened right out from the end of the pin to about $\frac{3}{8}$ of an inch above the cutting edges. Then lower the temper of the metal (most at and near the cutting edges), leaving the pin of a light straw color, which may be accomplished by pouring a little oil upon it during the lowering or tempering process. The object of this is to preserve it as much as possible from the wear due to its friction against the sides of the hole. For use on wrought iron and steel, this countersink (as also the pin drill) may have the front face hollowed out, after the fashion of the lip drill, and as shown in Fig. 111 by the dotted line.

For use on holes $\frac{1}{2}$ inch and less in diameter, either of the countersinks shown in Fig. 112 may be employed. No. 1 has



serrations forming cutting edges or teeth, and No. 2 is filled at the conical end exactly to half a diameter, the edge, A, performing the cutting. Either of them will cut true and smoothly, oil being applied when they are used upon steel or wrought iron.

Common drills, ground to the requisite angle or cone, are sometimes used as countersinks, but they are apt to cut untrue and uneven. For fine and light work, the pin drill, with its cutting edges either at right angles to the center line of the pin or at such other angle as may be required, forms the best countersink; it should, however, have more than two cutting edges, so that they may steady it. Fig. 113 presents an excellent form of this tool, A being one of the



four cutting edges.

This tool is formed by turning up the whole body, filing out the necessary four spaces between the cutters, and backing the latter off at the ends only, so that the circumferential edges will not cut, and hence the recesses or countersinks will be all of one diameter.

A New Mechanical Movement.

Mr. James R. Devor, of Goshen, Ind., has recently patented a device by which belts and pulleys, cog gearing, and other mechanism may be made to run on shafts which are out of parallel with each other. The arrangement is as follows: A ball is fastened tightly on each shaft, each ball having a socket composed of two disks, each of which has a broad slot through which the shaft passes, and which can turn to accommodate a shaft lying in any direction. The insides of the pulleys or cog wheels are made concave to fit the ball, having flanges which lap on the disks. The pulley or cog wheel is revolved by pins passing through it and the slots in the ball on opposite sides. The belt (when such means of transmission is used) is kept in place on the pulleys by guides supported by a rod which connects together the yokes on opposite sides of the ball. By this arrangement the ball is allowed lateral play, and the shaft to which it is attached can pass through the pulley at any angle.

The usefulness of this novel invention will be apparent to mechanics, and a great saving of pulleys, belts, and gearing will be effected by its use in transmitting power from one shaft to another when not parallel to it.

Useful Recipes for the Shop, the Household, and the Farm.

Vegetables should never be washed until immediately before prepared for the table. Lettuce is made almost worthless in flavor, by dipping it in water some hours before it is served. Potatoes suffer even more than other vegetables through the washing process. They should not be put in water till just ready for boiling.

The bluish green bronzes used for ornamental articles are very easily imitated. Almost any metal is first covered with a varnish made of ground tin or bronze powder rubbed up with honey in gum water. Then wash with a mixture composed of sal ammoniac $\frac{1}{2}$ oz., common salt $\frac{1}{2}$ oz., and 1 oz. spirit of hartshorn in 1 pint vinegar. After applying the mixture, leave for a day or two in the sun, and then, if necessary, add a second coat. This is a good way to renovate old gas fixtures.

The following is given as a simple welding powder: 1 part dry borax, 1 part fine iron filings, $\frac{1}{4}$ part prussiate of potash; it is sprinkled on the surfaces, the latter being previously slightly moistened. The pieces of iron and steel are then tightly bound together with iron wire, heated to about 300°, and lastly placed under a steam hammer or passed through rolls.

Leather thoroughly saturated with glycerin will prevent, it is said, the passage of gases.

In stamping sheet zinc in dies, much waste occurs from the small difference between the melting point and the temperature at which sheet zinc should be stamped to get the best effect. To obviate this waste, heat the zinc by dipping in oil at the proper temperature.

A cheap and simple brush for applying albumen solutions to photographic plates is made by doubling a piece of cotton plush cloth over the end of a flat stick, and securing the cloth by a rubber band slipped over it.

The following is a cheap substitute for the expensive gold varnish used on ornamented tin ware; Turpentine $\frac{1}{2}$ gallon, asphaltum $\frac{1}{2}$ gill, yellow aniline 2 ozs., umber 4 ozs turpentine varnish 1 gallon, and gamboge $\frac{1}{2}$ lb. Mix and boil for ten hours.

Beautiful semi-transparent casas of fancy articles may be taken in a compound of 2 parts unbaked gypsum, 1 part bleached beeswax, and 1 part paraffin. This becomes plastic at 120°, and is quite tough.

White lead ground in oil, mingled with Prussian blue mislarly prepared, to give the proper shade, and finally mixed with a little carriage varnish, is an excellent and durable paint for farm machinery and agricultural tools.

A mixture of 10 parts lime and 1 part saltpeter is said to destroy currant worms without injuring the fruit.

Boats should be painted with raw oil. Boiled oil used in the paint is very apt to blister and peel from the wood.

Spatter-work pictures, usually delicate designs in white appearing upon a softly shaded ground, are now very popular, and are, with a little practice, easily produced. Procure a sheet of fine uncalendered drawing paper, and arrange thereon a bouquet of pressed leaves, trailing vines, letters, or any design which it is desired to have appear in white. Fasten the articles by pins stuck into the smooth surface, which should be underneath the paper. Then slightly wet the bristles of a tooth or other brush in rubbed india ink, or in common black writing ink, and draw them across a stick in such a manner that the bristles will be bent and then quickly released. This will cause a fine spatter of ink upon the paper. Continue the spattering over all the leaves, pins, and paper, allowing the center of the pattern to receive the most ink, the edges shading off. When done, remove the design, and the forms will be found reproduced with accuracy on the tinted ground. With a rustic wooden frame, this forms a very cheap and pretty ornament.

It is said that water lilies may be raised about one's house by the following method: Sink in the ground the half of an old cask, and cover the bottom with peat and swamp mud, and then fill with water. Dig the lily roots early in the spring, and place them in the earth at the bottom of the tub. A gentleman who has tried the experiment has a number of lilies in bloom.

Whale Power vs. Steam.

On a recent voyage of the Cunard steamer Scythia, from Liverpool to New York, the progress of the ship was suddenly interrupted by collision with a whale. Two blades of the propeller were broken off, and the ship was obliged to put into the port of Queenstown for repairs. Here her passengers and freight were landed, and forwarded to New York by another steamer, after a week's delay. The whale, it appears, lost his life by the attack, for he was found afloat the next day by a party of fishermen, who towed him ashore The whale measured 54 feet in length.

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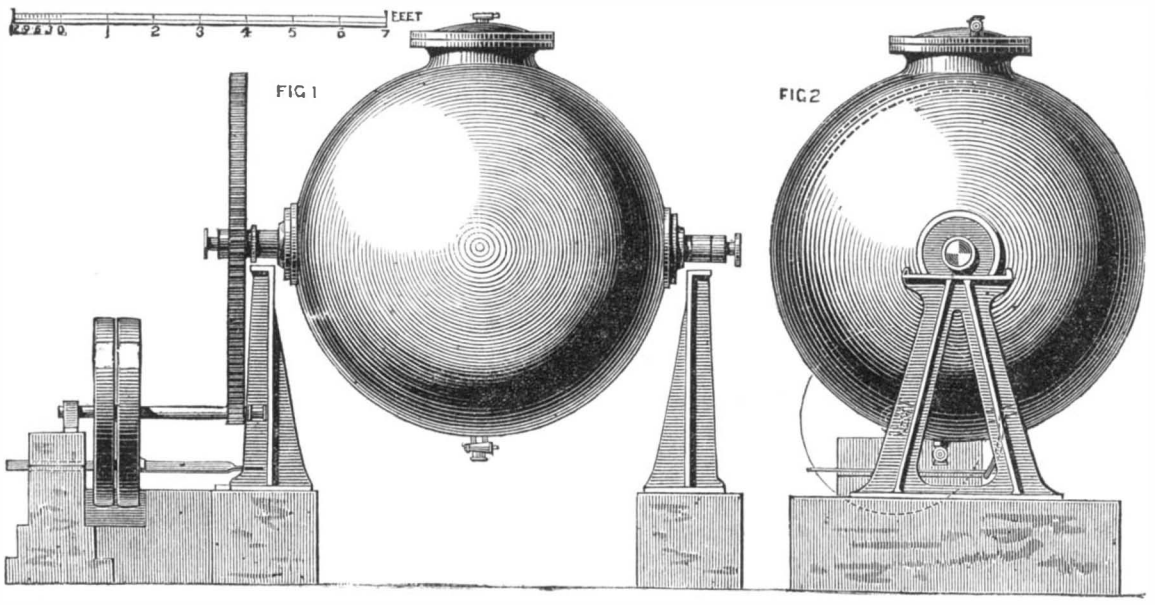
IMPROVED ROTARY RAG BOILER.

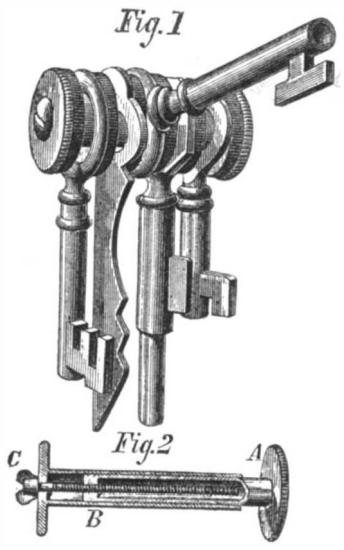
The rotary boiler, for paper stuff and similar materials, which we herewith illustrate, is the design of Messrs. Bryan Donkin & Co., of London, England. It consists simply of a spherical wrought iron vessel 8 feet in diameter, mounted on a pair of trunnions, both of which are made hollow for the purpose of admitting steam, while one of them carries a spur wheel, through which motion is communicated to the boiler. Inside the boiler are strainers to take off the dirt, and lifters which serve to agitate the rags as the boiler revolves. The flanges of the trunnions and the boiler are faced in the lathe, so that a good joint may be made with red lead simply. Owing to its spherical form, the boiler of course offers twice the resistance to rupture which would be possessed by a cylindrical boiler of the same diameter, and made of the same thickness of plates, while the spherical shape has also the advantage of being self-delivering, the rags falling out as the boiler revolves without the cover on. The gearing by which the boiler is driven is proportioned so that the vessel makes 1½ revolutions per minute, with the shaft carrying the belt pulleys running at 17½ revolutions. Altogether the boiler stands about 11 feet 6 inches high from the floor line to the top of the manhole, and in practice it is mounted so that it may be filled through an opening in the floor overhead.



DONKIN'S RAG BOILER.

COLEMAN'S KEY HOLDER.

The annexed engraving represents a simple little device designed for holding keys in a bunch, and intended as a substitute for the ordinary key ring. It consists of a central core or shaft made in two hollow portions, A and B, Fig. 2. Part A enters part B, and a solid portion at the extremity of the former receives the screw-threaded stem, C, which holds the two sections together. Upon the core the keys are placed, and disks of leather or other pliable material are interposed between them, as shown in Fig. 1. The bunch is retained



in place by bringing the two parts, A and B, together by means of the screw, caps on the end preventing the keys from slipping off.

The advantages claimed for this device are that all jingling of the keys is prevented, the latter are held more tightly and in more compact shape, a better leverage is afforded for turning any key in its lock, and the bunch does not hang down, and thus scratch against the polished surface of furniture.

Patented through the Scientific American Patent Agency, July 20, 1875. For further particulars address the inventor, Mr. F. W. Coleman, Rodney, Jefferson county, Miss.

Mysterious Boiler Explosions.

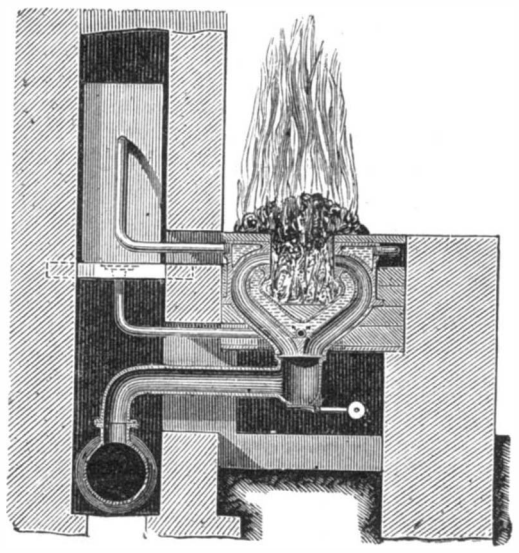
There was a time when people thought that boiler explosions were caused by lightning. Later, this theory was modified, and it was said that electricity was an active agency in boiler explosions, and to this day the latter theory is entertained by many. There has always been a desire to surround these accidents with mystery; to devise some theory that men of ordinary intelligence cannot comprehend. The promulgators of these theories have a fancy for surrounding themselves with an atmosphere of superior intelligence, somewhat akin to the alchemists and astrologers of old. They use unfamiliar technical terms and derivative words, when plain Saxon would be much more to the point, and this they call scientific. When a boiler explodes, people desire to know what was the cause. If they are entertained with theories of suspension or repulsion, when portions of the boiler were found corroded almost to the thinness of paper, they might very properly say "that's too thin." And if, upon careful examination, it was pretty definitely ascertained that the boiler let go at the weak or thin point, any theory founded upon suspension or repulsion would be likely to have little weight with people familiar with steam boilers.

It is well known that any piece of machinery in which there is a weak point must be handled with great care. It must not be overloaded, but the load or strain must be adapted to the weak point. The theory that the strength of any structure is measured by its weakest point is as true of boilers as of any thing else; and when a boiler has a decidedly weak point, it should not be used except at a very low pressure. A safer way would be to repair at once, and thus approximately restore the boiler to its original strength. A boiler may be corroded in places difficult to discover unless a thorough examination is made when the boiler is cold, and the owner may not know that the pressure which he is using is close up to the ability of the metal, at its weakest point. Under these latter conditions, it will be readily seen that a little excess of pressure only will be required to pass the limit of safety. The weak spot gives out, and damage to a greater or less extent occurs.

A weak spot in a boiler or any other device, does not improve by use; and when a machine breaks down at a point which is ascertained to have been weak for a long time, no one is impressed with the necessity of going into a long discussion to show that mysterious agencies were suddenly brought to bear upon the weak point, causing the break. The fact is the point of fracture was unable to sustain the load imposed upon it. It did its very best, but when the load was not lessened, yet the deterioration of metal continually went on, a time came when, from inability to hold on longer, the machine broke down. Is there any mystery about it? Is there any mystery about the fact that a boiler 6½ feet in diameter, running at a pressure of 75 lbs. to the square inch, with one of the sheets corroded to the thinness of paper, exploded, doing serious damage? We think not, and we further think all efforts to surround such cases with mystery worthy only of those who have soared so high into the regions of theory that they are reluctant to step down before, and into the presence of, facts and common sense. Boilers should be periodically inspected with much care, so that any indications of weakness may be discovered before it is too late. There are few, if any, defects that careful external and internal examination, with chisel and hammer, will not discover; and we would advise all boiler owners to secure the services of some competent man to examine their boilers carefully at least once a year.—*J. M. Allen, President of Hartford Steam Boiler Inspection and Insurance Company.*

SEEL AND SHAW'S TWEER FOR SMITH'S USE.

We annex an engraving of a tweer for smith's use, in which the blast is divided into two jets, led respectively to opposite sides of the fire. The tweer is branched for the beforementioned purpose, and is protected by a water casing, which



can have a branch pipe cast on it for connecting it with the water tank; but the usual method of supplying the water is as shown in our engraving. This is a convenient arrangement, and is well adapted for quickly raising an intense heat.

Patented by Ephraim Seel and Thomas Shaw, of Greenfield, England.

Increasing the Solubility and Disinfecting Power of Salicylic Acid.

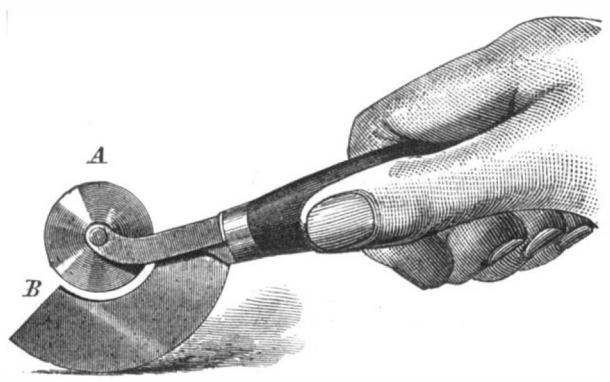
One of the disadvantages attendant upon the use of this long known, but recently introduced, tasteless, and harmless disinfectant has been its very slight solubility in water. The phosphate of soda increases its solubility somewhat, but it has been reserved for a chemist with the euphonious name of Rozsnyay to discover a better means than this. The salt employed by this chemist is one which itself possesses a certain antiseptic power, and this increases the power which the mixture has of retarding putrefaction. This salt is sulphite of soda. If one part of salicylic acid and two parts of sulphite of soda are dissolved cold in 50 parts of water, the solution will be perfectly clear. The solution does not irritate an open wound in the slightest, and its disinfectant power is so great that, while a certain quantity of milk, to which had been added a solution of salicylic acid prepared with phosphate of soda, curdled in five days at ordinary temperature (66° Fah.), another portion of milk, to which was added a solution of salicylic acid prepared with sulphite of soda, remained fluid for two weeks.

Rozsnyay recommends one part salicylic acid and one or two parts sulphite of soda dissolved in from fifty to one hundred parts of water, for general use.

BRECHBIEL'S CIGAR WRAPPER KNIFE.

The invention illustrated in the annexed engraving consists in a combination of two cutting blades secured in a handle, each blade performing a separate office in cutting out the wrappers of cigars. A is a circular knife, which cuts the leaf into the necessary semicircular shape without tearing, an accident likely to happen when the tobacco is dry and the fibers large and hard. From between the bifurcated shank of blade, A, projects the curved blade, B. This serves to shape the leaf in order to form the tip of the cigar, and possesses the same advantages for this employment as the circular knife for its particular purpose.

The tool ordinarily used somewhat resembles a shoemaker's knife. It requires skill in its manipulation, and must be kept constantly keen in order to do its work properly,



the present device requires sharpening but seldom, and it is in many respects a convenient and handy implement.

Patented May 4, 1875. For further particulars relative to sale of patent, address the inventor, Mr. John E. Brechbiel, Highland Falls, Orange county. N. Y.

Another Bridge between New York and Brooklyn.

By an act of the State Legislature of New York, a second bridge over the East River, between New York and Brooklyn, was, some time ago, duly authorized. No such expensive and difficult undertaking as the great suspension bridge now in progress, is required in this new enterprise.

The new bridge is to extend from 78th street, New York, to Lockwood street and Graham avenue on the opposite shore. The East River, at this point, is divided into two comparatively small streams, by the long narrow strip of land which occupies the center of the river, known as Blackwall's Island. The central piers will rest on this island. The greatest span of the great suspension bridge near Fulton street is 1,600 feet; but the widest span of the new bridge will be less than half of that distance. The total length of the bridge and approaches will be two miles. The largest spans are 715, 600, 367, 320, and 300 feet respectively. The section comprises a double track, a carriage way, and two foot ways. The trussed girder system of construction is talked of.

Back Numbers for the Current Year.

We would state, in answer to numerous inquiries whether all the numbers of the SCIENTIFIC AMERICAN can be had for the year 1875, that they can be furnished from January to the present time, in sheets, or in volumes of 416 pages, bound, up to July 1. The price for the bound volume is $3; in sheets, from January to July, by mail, $1.60. New subscribers can have all the back numbers if they wish. But, unless requested otherwise, all subscriptions will be commenced at time of receiving the order.

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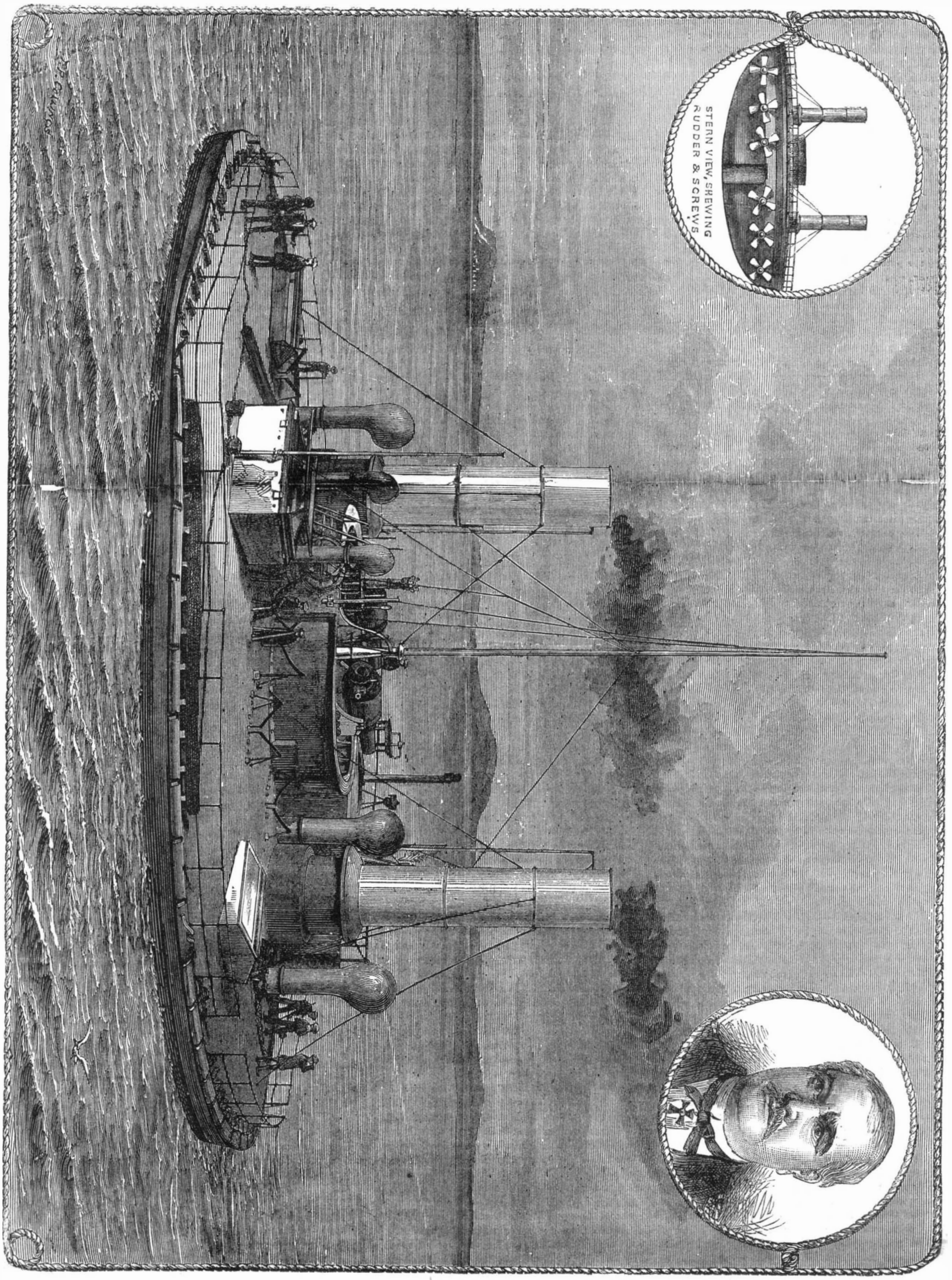
THE RUSSIAN CIRCULAR SHIP.

We have heretofore informed our readers of the construction by the Russian government of a circular ironclad man of war, intended chiefly for defensive purposes and harbor service. The form of the vessel was chosen to secure maximum tunnage with compactness, and to present as little broadside as possible to the enemy. Moreover, it would be necessary to strike the vessel nearly point blank to produce any effect on her sides, as a very slight angle of inclination would cause shot and shell to glance off her at a tangent. Owing to the greater displacement in comparison with the weight of hull, vessels thus built can carry much heavier armor and weightier guns that would be possible with those of the longitudinal form. This principle, which has been partly carried out by Mr. Reed in his broadening of vessels to obtain greater displacement, has been found to answer most satisfactorily, and notwithstanding that the tonnage of the Novgorod is 2,491, she only draws 13 feet 2 inches of water, with all weights on board, and with a longitudinal false keel. The armor plates are 9 inches thick, and are backed with channel iron to the amount of 2 inches, so that the armor is virtually 11 inches thick. Moreover, from her circular form, the Novgorod is of an uniform strength throughout, and presents no weak point. The deck, which measures 101 feet in diameter, is also plated to the depth of 2¾ inches, while a thickly armored breastwork protects the guns, which are worked in an open turret so as to ensure greater precision of fire, and which can be moved and fired either independently or together, as may be required. The guns are two in number, of 11 inches bore, and weigh 28 tuns each. The vessel is propelled by six screws worked by engines of 480 nominal horse power (see the small engraving in the left hand upper corner of our picture). The speed attained is said to be equal to that of the monitors; but as the vessel is said to be used for defending the mouths of rivers and weak portions of the coast line, a high speed, though desirable, is scarcely absolutely necessary. The rolling and pitching of the Novgorod are said to be far less perceptible than in vessels of an ordinary type, owing to her flat bottom. She was launched in the early part of last year, at Nicolaieff, on the Black Sea. Another vessel of the same type is being constructed. She will be of a larger tunnage, and will bear armor 18 inches thick.

Vice-Admiral A. A. Popoff, the designer of this type of ironclad, whose portrait we give in the upper right hand corner o the engraving, is the son of a Russian naval architect, and is



THE RUSSIAN CIRCULAR IRONCLAD "POPOFFKA NOVGOROD"

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about fifty years of age. During the Crimean war he served with the fleet in the Black Sea, and distinguished himself by burning several of the storeships of the allied fleet. At the close of the war he superintended the construction of a large number of fast steaming vessels, and the most powerful ironclads of the Russian navy have been built according to his designs. Thus, in addition to the circular ironclads (which are called Popoffkas after him), he is the designer of the Peter the Great, concerning which there was so much controversy last year, and of the fast corvettes of the Duke of Edinburgh class, with armor along the water line, similar to our Nelson and Northampton. In addition to his shipbuilding labors, Admiral Popoff has cruised several times round the world in command of the Russian squadron.

The Proposed Changes in the English Patent Laws.

At a recent meeting held under the auspices of the Institution of Mechanical Engineers, to take into consideration the proposed bill for amending the British patent law:

Mr, Bramwell, the president, said there could be nobody so interested in inventions as was the body of mechanical engineers. Among that body were to be found many of the greatest inventors of the age, and men who in their manufactories were day by day carrying out the results of inventions of themselves, or of others; and thus in the two-fold capacity of inventors and producers, the members of the institution were deeply interested in inventions. He thought that the majority of the press and the public had determined that invention had gone on as it had done in consequence of the existence of a good patent law, which was essential for the protection and for the increase of inventions. The law of 1852 was perhaps not faultless, but it worked very well. A commission sat in 1865 to consider it, and a committee sat in 1871 to consider it, and both recommended certain legislation upon the patent law. Nothing had been done until the present year, when the Lord Chancellor brought in a bill which at the present time formed the subject of the attention of Parliament and of the attention of the members that day. In many respects it would be found that it departed from the recommendations both of the commission and of the committee; and therefore it might be taken that those two bodies, who each had before them a quantity of extremely good evidence, in investigating the matter with the greatest care, had to a large extent their labors thrown away by the present bill, without due attention being paid to their recommendations.

Mr. E. A. Cowper proposed a resolution: "That this meeting is decidedly of opinion that the Patents for Inventions Bill, 1875, proposed by the Lord Chancellor, would be much worse in its operation than the act of 1852." He thought that the patent laws had proved the greatest possible stimulus in this country to the progress of manufacture and invention. He scarcely thought it necessary to go into the merits of the patent laws, because he thought all were agreed that the patent laws were most important. He had looked through the bill and found ten distinct places where the Lord Chancellor had power given to him to refuse all patents, and the way in which it was done seemed at first sight plausible. There might in this way be an absolute destruction of the patent laws. It only depended on how far public opinion would tolerate such a thing as the Lord Chancellor putting his foot down upon every patent applied for. The Lord Chancellor had absolute power, he had power to make rules and regulations, and power even to settle any cases of dispute about licenses; in that way he had full power to destroy a patent whenever he thought proper. He believed they were all agreed that the provisional specification was a good thing, and yet the proposed bill swept it away. Then there were examiners to be appointed who would be entirely irresponsible; they would be something like the examiners of the Patent Office in America, and he must say that the action of those examiners was not very satisfactory. There was a staff of about 400 persons appointed. If an invention was reported upon adversely, there was then a reference to other examiners, then to the commissioners, and finally it was referred to the head commissioner, and sometimes, after having gone through several steps at great expense and great delay, the head commissioner reversed everything that had been done before. He had great pleasure in proposing the resolution.

Mr. William Smith, in seconding the resolution, said he entirely concurred in what had fallen from Mr. Cowper. He had looked into the contents of the bill, and had made some inquiries as to its history. He found also that the Attorney and Solicitor General had never been consulted, and curiously enough, Mr. Woodcroft, a gentleman in whom was centered the whole of the information in connection with the Patent Office and the administration of the patent law, had not been considered. He was not, therefore, surprised that a bill should be introduced which gave no satisfaction to any one except to the enemies of patent laws. It was clear that the measure had been framed entirely for the purpose of neutralizing those laws. It was, in truth, "a delusion, a mockery, and a snare," a snare it most certainly was. Mr. Cowper had mentioned ten, but he believed there were in reality seventeen, cases in which the administration of the patent law was placed solely and exclusively in the hands of the Lord Chancellor. Anything more opposed to public policy than the Lord Chancellor's bill it was scarcely possible to conceive. He maintained that the present eminence of this country was to a great extent due to the wise provision that had been made in regard to patents, but the Lord Chancellor's bill would take away all protection from that important class of property known as invention; and unless a strong effort were made by all the important interests of the country to stop the progress of the bill, the results would be very disastrous.

Mr. Carpmael said if the country desired inventions to be made it must pay for them in some form or other. There must be room for the inventor to succeed in the battle of life, in the competition that goes on, otherwise the race of inventors may soon become extinct. In the House of Lords, from the debates which took place on the second reading of the bill, they learned that public opinion was not at present sufficiently educated to allow of the abolition of patents, but this was a bill which would pave the way for this not very desirable consummation. No bill which was introduced to the notice of Parliament on the subject of patents could be satisfactory to inventors or those who sympathized with them. For example, he was one of those who considered that examination and investigation of applications for letters patent in some form or another was desirable; but when he asked himself the question: "Is the examination contemplated by the promotors of this bill a fair and *bona fide*, honest examination, or is it not, on the contrary, the wholesale rejection of applications for letters patent which will be expected at the hands of examiners?" he really knew not what to reply. There was nothing whatever in the bill to prevent its being used as an instrument of wholesale slaughter of patents.

Mr. Smith did not think that Mr. Carpmael thoroughly expressed the opinions of a large section of the class of inventors, and of those who had an interest in invention, in saying that some system of examination was desired. He believed if all the inventors in the country were polled, it would be found that rather than have such an examination as was provided for in the bill, or even as that shadowed forth by Mr. Carpmael, they would prefer to take their chance. They were the best judges of what they wanted, and the question of whether there was any infringement of a patent could easily be dealt with. The best method to employ, in the opinion of a large number of persons, was to have a larger number of libraries offering facility of examination to all inventors, so that everything that had been done could be easily ascertained. This would be far better than the employment of an expensive staff of examiners, who after all might not thoroughly understand the inventions submitted to them.

Mr. Camplin said he believed there was great feeling among inventors in favor of a proper system of examination; but he thought that an examination into the novelty of an invention must always be a matter of considerable difficulty; and unless there were at the Patent Office full and complete indexes, giving an opportunity to the examiners of going into the different inventions that had been already passed, the office of examiner would be a useless one—it would be impossible for them to do their work satisfactorily without having all those appliances at hand. If, however, those indexes and appliances were placed at the service of inventors, they might enable them to do for themselves the very thing which the expensive examiners were appointed to effect. The provisional specification was of great importance to the working class of inventors for two or three reasons. In the first place, they were not likely to be able to put their ideas into such a form as would satisfy the requirements of the law. They would therefore require professional assistance, which would entail considerable expense at the outset; during all that time they would be waiting for any protection which might enable them to negotiate with employers or capitalists with a view of getting their inventions carried out. Nearly all the petitions that had been sent to the House of Commons on the subject spoke of the abolition of the provisional protection as a thing that would be greatly detrimental to the class of inventors.

Mr. E. Newton said that the object of the resolution, which was passed, appeared to him to have been to get rid of the bill altogether; and perhaps that was cutting the Gordian knot in the right way, because unless some very serious alterations were made in the bill, there was no doubt that it was intended for the purpose of abolishing patents altogether. But inasmuch as they must be prepared for the bill passing the second reading and getting into committee, it became necessary first to consider in what way the bill should be amended, or whether they should or should not point out some things that really required excision from the bill and that some others should be introduced in their stead. He quite agreed that it would be better to retain the provisional specification. It was all very well to say that England was the only country that gave provisional protection. It was the only country in which a general description of an invention could be deposited, and a protection of some kind or other obtained for it. In all other countries a detailed description had to be given, illustrated with drawings, and sometimes with a model, setting forth the whole nature and object and scope of the invention; but those who stated that forgot one thing. In the first place, for instance, in America patents were much less expensive than they are here; in France and Belgium they were also less expensive; but beyond that, in France, during the existence of the patent, various improvements and additions could be added on to the original invention, and therefore if something has been omitted in the original specification it could be added on from time to time as these things occur. In America the patent could be re-issued, the original patent could be delivered up if it was found defective in some points, and anything that had not been properly described in the drawing could be included in the re issue. Under these circumstances it appeared to him that England was in a totally different position to foreign countries in regard to this question.

As regards examination, he was one of those who originally strongly objected to it, because he had seen the absurdity of it in the United States. The examination there was supposed and theoretical. The law was as good as it could be, but it worked exceedingly badly. He had seen instances in which inventions had been patented over and over again. Mr. Cowper, he knew, had before him a number of extraordinary instances in which inventions had been patented over and over again in the United States, notwithstanding the boasted examinations which these things are supposed to have gone through. He agreed with Mr. Carpmael that an examination of some kind would be an advantage. He would move: 1. That any preliminary examination of applications for letters patent that may be hereafter instituted should not extend beyond the questions whether the specifications are clear, and whether the invention is open to objection on the ground of want of novelty, regard being had to prior publications in the Patent Office. 2. That an adverse report should not disentitle an applicant to a patent. 3. That in lieu of the proposed publication of reports (which would in many instances operate unjustly) the applicant should merely be required to insert in his specification an acknowledgment of the existence of the prior matter found and pointed out by the Patent Office officials, with a clear statement of what he claims notwithstanding."

Mr. Lloyd Wise said the proposal that, notwithstanding the adverse opinions of examiners, patents would be allowed, had been supported by the Associated Chambers of Commerce, the Society of Arts, the Society for the Promotion of Scientific Industry, and others, and was a very good one if taken in conjunction with the proviso, in Mr. Newton's resolution, that adverse reports should not be published, the examination being one as to novelty alone. If the insertion of acknowledgment of prior matter in the specification was required, the public would be effectually informed as to the nature of the invention.

Dr. Siemens said he thought they had all learned a lesson within the last few months. It was not more than two or three months ago since they had an important paper by the president, before the Society of Arts, on the question of the patent law, and at that time the voices were many and loud against the existing patent law. He was, perhaps, in a great minority in saying that he thought the existing law not bad, and that before they lifted a stone against it they should be very careful as to what they got in its stead. They had got something in its stead now, and he thought they ought to be very grateful to Lord Cairns for having attacked the question so boldly. He had benefited both classes, both the applicants for patents and those opposed to them; the former in showing them they really had a valuable patent law, which might be susceptible of improvement in detail, but which contained many important provisions which distinguish the English patent law before the patent laws of other nations. Opponents of patents would have learned by this time that it was not so easy to knock patents on the head. The opposition that had been raised against the provisions of the bill now before Parliament was so decided, and so well supported by reason, that he doubted very much whether the bill would go on, and perhaps next year or at some future time there would be a bill which would not attempt to undermine the patent laws, but which would be conceived with a view of improving them. In that case he was sure that all true friends of industrial progress, whom he would identify with friends of patent administration, would support such a measure. There seemed now to be very little difference of opinion with regard to the main features of such a patent law as would satisfy all classes. The most difficult point, and one on which they had that day heard different opinions expressed, was that of preliminary examination. Looking to the working of that system in other countries, it was found that it existed in America and in Prussia. In America it existed with a bias in favor of inventors. The American legislature favored the applicant, and, if any abuses arose, they were abuses inherent to that system of examination with power of rejection. In Prussia there was a system of examination with a bias against patent laws altogether. It appeared to him if the bill of Lord Cairns was to pass into law, the examinations would approach more nearly to the Prussian. The commissioner appointed would be instructed to seek for an excuse to refuse them, rather than try to modify the application in such a way as to give the applicant the benefit of the patent; and that being the case, he thought they should be very careful how to accept this clause of the bill. The question was involved in difficulty, and he must say that he had not found a formula that would altogether satisfy his own mind. Examination was decidedly useful; it gave the applicant information which must be useful, if it would stop there. Would it not therefore be sufficient for the examiner to point out to him clearly what had been done and what had been proposed to be done, and to warn him that in his claims he must avoid those breakers ahead? Nothing more was necessary. They need not go the length of printing a condemnation upon his very door. They might tell him, "This, that, and the other, is known, is published; avoid it; but we do not advise you to proceed or not proceed with your application." Some such medium course would probably get rid of the difficulty, which was a real one; but in all other respects he thought that the friends of the patent law, and those who had had experience of patents, seemed to be all agreed. So that it was unnecessary for him to enlarge upon any portion of the bill. He could only therefore concur with the resolution that had been proposed and seconded, and he hoped it would be carried.

Mr. Napier thought the bill should not pass in its present form. There was a strong feeling in favor of patents. He had been connected with them for many years as manufacturer and patentee, and when he read the bill he was very sorry to think that the Lord Chancellor should have framed

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t. As far as he could judge, it seemed to be ignorantly framed. Having had to do with a large number of patents, he thought it was really necessary to have a provisional specification. He thought it was undesirable in any way to limit and tie up the patentee. It had been said that the patentee should be looked after, that he should be patronized; but he was afraid that in the House of Lords there was no real intention of patronizing the patentee. Indeed, the patentee did not require patronage; he required to be left alone, to have freedom. Speaking for himself, if he wanted any one to examine what he considered an invention, he would ask them. If the patentee wanted assistance, it should be furnished to him for nothing, and if that were done then the patentee would be in a right position. A patentee was naturally anxious to know whether there had been a previous patent which he would infringe upon. He did not want to take out a patent which had been taken out before, because he knew that the result would be to ruin himself in that particular thing. Therefore he was very anxious for his own safety. He therefore thought it very desirable to leave the patentee alone. He was a very useful person, in fact the whole of the progress of the country depended upon the inventor. That was saying a great deal, but if they looked into the library of the Patent Office and scanned the amount of mind that they found there shown in print, and if they could only suppose how in any other way but by patent law that mind had been used for the improvement which they found there indicated, he thought it would be impossible to conceive how by any other means than by patent law there should have been so much progress made.

Mr. Smith said it might be well to adopt the French system and require payment of, say £5 on application, and £5 a year afterwards. He did not wish to see the patentees patronized, but every means should be given them to enable them to judge for themselves, and also to employ such men as Mr. Carpmael, from whom they would get more assistance than they could from a large staff of examiners. He would give inventors the full benefit by taking off the enormous taxation in the third and seventh years, and making the payment an annual one, so that the patent could be dropped at any time.

Mr. Carpmael said there were, no doubt, abuses in the American system, but they had been often exaggerated. There was a reason for those abuses that did not exist in England. The American civil service was entirely political, and every one of the staff of the Patent Office had to subscribe a part of his salary to keep his party in office. With regard to the search, Dr. Siemens said that a search by a patent agent was expensive, and it could not be otherwise. When a patent was instructed to make a search, he had to build a scaffolding for the purpose, but in a government department there would be a scaffolding available for the public generally. He had taken out patents in America, France, and Belgium. In France and Belgium there was nothing to do but to ask for a patent, and he valued it according to the facility with which it was given. In America the process was very long; and separate patents were required for different details that would be included in one patent in England. That brought up the cost to about the same amount as in this country. He did not see how they could do much better than carry out the act of 1852 in its integrity. The bill of the Lord Chancellor was wholly uncalled for. Patentees had not agitated for it, and he did not regard the House of Lords as a body well qualified to judge of their requirements. He thought the bill would have very little chance in the House of Commons.

Mr. Smith thought it advisable to pass such a resolution as the following:—"That this meeting is of opinion that many of the provisions in the Lord Chancellor's Bill are contrary to public policy, and an interference with the admitted rights of inventors and others connected with property in invention."

Mr. Newton seconded the resolution, which was carried.

The President said that the bill, as they were aware, had passed the House of Lords. He had the highest respect for that body, but he did not think it was a tribunal he would select for the purpose of determining upon the policy of the patent laws. He believed that the Lord Chancellor, in the very speech in which he introduced the bill, showed that he was not very practically acquainted with manufactures. His recollection was that, when the Lord Chancellor alluded to the new process of toughening glass by steeping it when hot in oil, he spoke of it as being in contradistinction to that process, ordinarily pursued in glass manufacture, by steeping it in cold water. He thought it would be found, on reference to his speech, that that was the Lord Chancellor's opinion on one of the processes in glass manufacture. Lord Somerset who, having been at the head of the Admiralty, should, he thought, have had a little respect for inventions, was very jocose. He said that an inventor came and made a screw wide at one end, and another came and made it narrow at that end, and that gave him the right of patent, on which there was great laughter. It might have occurred to his lordship that the whole difference between a good screw and a bad one lay in the form of it, and that it was not until after years of experiment that a good propeller was obtained. Even at the present day they knew it was a disgrace to mechanics that they could not get a propeller that would utilize a greater percentage of power than was got by the screw. But he thought it was a matter of complaint that the patent law was made the property of lawyers. The bill had been framed by a lawyer without consultation with those who did know something about it; it entirely passed by several of the recommendations of the commission of 1865 and the committee of 1871-2, and it contained clauses that were in themselves most prejudicial. He was glad that the opponents of the bill had been furnished with powerful arguments against it at the present meeting. They might not be wanted for the present session, for he hoped the bill would be not among the "innocents," but among the wicked, that would be slaughtered; but as it might revive next session, he hoped that the proceedings of that day would have their due weight; and he hoped, if needful, that the members of the Institution of Mechanical Engineers would meet another year to protest against a bill so injurious to the interests, not only of inventors, but of the country.

In Memoriam.

He used to make his appearance at our desk about once a week, for nearly ten years. He always carried a musty roll of drawings, which seemed to be a little more worn and a little more yellow at each visit. Eventually they came to look like the part of his coat against which they rubbed—dirty black and shiny. He was very patient; perhaps he gave us credit for being so likewise; besides, he was deaf. Therefore, he could wait and glare benignly though vacantly, over his rubicund nose, upon us until we had finished with some preceding visitor. Our part of the conversation was confined to nods, interjected whenever we became aware that he had stopped for breath.

Some years ago we understood a little of his story, but it departed from our recollection. It was too complicated: we either had to forget that or everything else. We did not tell him so, however, and consequently he supposed we were blessed with a stupendous memory; for after he had finished his invention and begun on the improvements, of which he had a new one to describe every time he appeared, he assumed that we remembered all of his previous oration. He improved his original notion out of existence several times, so that in the end his dilapidated drawings had nothing to do with the subject of his remarks. That idea occurred to him eventually, and he neglected to show them. This was after a great many people got impatient in attempting to reconcile them with his description. He would talk none the less, however, making enormous drafts on our imaginary faculties for comprehension, and on his own for facts. He believed that alcohol was food, and practically tested his theories frequently, which did not improve the coherence of his remarks nor the aroma which pervaded his presence. We found out, after a while, that we were a kind of mental safety valve for him. So long as we would listen he was happy; and doubtless, when he slowly departed toward the nearest bar room, his moral refreshment was equaled in degree only by his physical dryness.

This article is an obituary. It may be a peculiar one, but not more peculiar than its subject. We have missed him and his roll of drawings for about one week. There is a competition in progress, before a committee which sits daily, of schemes for a great city improvement. He entered the lists of competitors with that roll of drawings. Somehow he became possessed of the idea that he had distanced all rivals, whereupon he indulged in a too prolonged banquet. Then he tumbled down stairs and broke his neck.

In the above will be recognized a character well known about New York city, a genius of more than ordinary cleverness, and an engineer of practical skill; but his hobby and his habits killed him.

City Bee Culture.

A manufacturer of a summer drink, which seems to be quite popular during the present heated weather, has taken a store in the neighborhood of our offices, and placed in the show window a beehive, in which, in full view of the crowd which constantly gathers, the busy insects make the honey which, it is asserted, is mingled with the cooling beverage. The window is open at the top, and the bees are allowed to collect their materials from the street refuse. The honey seems to be of excellent quality, and the bees require no further care nor attention than if foraging among their favorite clover fields.

At the Fair of the American Institute last fall, a very fine case of honey was exhibited, the contents of which, we were informed, had been obtained by the bees entirely from the swill barrels, the sugar-house waste, and the flowers in the public parks of the city. There was nothing about the material to distinguish it from the best honey made from clover, and it undoubtedly should and probably did find a market just as readily. The quantity of such honey-yielding refuse wasted in the metropolis is enormous. Why then should it not be more widely utilized through the bees? Private apiculture can be carried on just as well on a house top or in a back yard as upon a farm, and any one with such space at his disposal might easily manage a few hives and build up a paying business, and it would afford amusement to the experimentor and his friends. There are many people, out of the thousands seeking work here just at present, to whom some such new occupation—for such bee culture would be, thus carried on in the city—might be of considerable assistance in eking out a support during the stagnation of business peculiar to the heated term.

A contemporary suggests bee culture as an excellent employment for women, an idea with which we fully concur. A case is mentioned of a lady who started with four hives purchased for $10, and in five years she declined to sell her stock for $1,500, it not being enough. Besides realizing this increase on her capital, she sold 22 hives and 436 pounds of honey. Another instance is on record, of a man, who, with six colonies to start with, in five years cleared 8,000 pounds of honey and 54 colonies. Fine honey readily fetches, at retail, from 25 to 40 cents a pound.

SIR WILLIAM EDMOND LOGAN, the distinguished geologist, died recently at the age of seventy-seven years.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

GILBERT & BARKER MANUFACTURING COMPANY *vs.* OAKES TIRRELL.—PATENT GAS APPARATUS.

[In equity.—Before WOODRUFF, Circuit Judge.—Decided June, 1874.

WOODRUFF, F. J.:

The bill herein is filed to restrain the infringement of a patent granted to J. F. Barker and C. N. Gilbert on the 3rd of August, 1869, for an approved apparatus for carbureting air.

By means of this apparatus, it is claimed that gas is produced from petroleum and similar volatile oils employed for carbureting atmospheric air, thus rendering it combustible, light-producing, and suitable for lighting houses, manufactories, etc.

Neither the process nor the chief parts of the apparatus are claimed to be new. The claim in the patent which the defendant is charged with infringing is in these words:

The arrangement of the carbureter with a motor wheel, said motor wheel being driven by a descending weight or other equivalent mechanical power applied to force the air through the carbureter to the burners, said carbureter being placed within a vault by itself, separate from the building to be lighted, the whole arranged and connected with pipes, substantially herein—that is, in the specification—described and set forth.

It appears by the proofs that, prior to the invention of the patentees, attempts to produce and bring into general use gas manufactured by forcing atmospheric air through or in contact with volatile oils under such pressure that it was suitably impregnated or carbureted were liable to two difficulties.

The chief of these was that, under any already devised arrangement, the danger of explosion, as an incidental result of the escape of gas from the carbureter, was very great; and this not only *per se* hindered its use, but made it difficult or impossible to procure insurance upon buildings so lighted. Another difficulty lay in the fact that, in passing the gas from the carbureter through the distributing pipes, whenever the temperature of the pipes was lower than that of the carbureter, condensation occurred, which produced in the pipes not an obstruction merely, but a highly inflammable liquid, greatly inconvenient and dangerous.

If an attempt was made to obviate these objections by locating the apparatus in apartments separated from the building lighted, there was a necessity to provide for the changes of temperature in our ever-varying climate, which were liable to cool the carbureter to a degree which made it practically inoperative; or, if the apartment was artificially heated, the danger of explosion was not avoided.

I shall not enter very fully or minutely into discussion of the details of the patented apparatus, since most of them are confessedly old.

The chief feature of the improvement is in the placing of the carbureter underground, in a vault separate from the building to be lighted, at any desired or convenient distance therefrom, while the power and the motor, by means whereof the atmospheric air is forced through pipes leading into the carbureter, is placed in an apartment in the building, or near thereto, conveniently accessible with or without a light, as occasion may require, whenever for adjusting the motive power or machinery thereof it is desired to do so. Such apartment being thus wholly separated by walls or intermediate earth, or both, no gas from the carbureter pervades it, and no danger of explosion arises.

Besides this result, which may be claimed to be purely incidental, and perhaps not novel, because it would result from any mere separation of the two parts of the apparatus by placing them in different apartments, a most important result is effected in making such separation practicable, and at the same time producing an even, regular supply of the gas by the carbureter unaffected by changes of temperature above ground, and effecting also a preliminary condensation before the gas enters the distributing pipes, which relieves the operation of the apparatus from the objection secondly above named.

Three questions are hereupon raised. Was this new arrangement patentable? Was it new, and were the patentees the first inventors? Does the defendant infringe?

1. Upon the first question it is insisted that the patentees merely changed the location of the carbureter, and that the mere change in the location of an old device is not patentable.

In Marsh *et al. vs* The Dodge and Stevenson Manufacturing Company, in the Northern District, at the June term, 1873, (5 *Official Gazette*, 395) I had occasion to say that "mere change of location is not invention." But it was also held that "where change of location involves the employment of new devices to adapt an apparatus for use in the new position, and a beneficial result is produced, then this location, in its connection with such new devices—that is the means by which the result is produced, and not the result itself—is patentable; and where such change of location brings into existence a new combination to produce a new and useful result, such new combination is patentable."

This illustrates the nature and patentable character of the arrangement described in the patent in this case. By the new arrangement the patentees bring into contributory and effective coöperation, with a carbureter and the machinery for supplying atmospheric air thereto, the earth and its even temperature below the surface, and obtain protection from the efflux of gas from the carbureter and its accumulation in the frequently visited location of the motor, and from the danger of consequent explosion, and secure, by the passage of the gas from the carbureter through a cooler medium, the preliminary condensation, which makes the use of the gas in the building and its passage through the distributing pipes safe, convenient, and valuable.

It is no impeachment of the patent to say that this is only making use of the natural laws which, operating below the surface, make such new location desirable as a matter of mere judgment. It is more than that. It brings into conjoint operation and effect new elements, working actively and also operating passively to produce the result, and to produce the ultimate and final result in a better manner—in a manner which combines safety with convenience and utility as had never before been.

The most important inventions ever made consist in subordinating natural elements or controlling natural laws to the production of useful results.

I cannot doubt that the invention of the patentees was patentable, as truly so as it is abundantly proved to be greatly useful and valuable.

2. The questions of fact—was this arrangement new, and were the patentees the first inventors—must be answered in the affirmative.

I cannot, in a brief opinion, review in detail the evidence. I must content myself with saying that, after a careful examination of the testimony and attention to the very full argument of the counsel, the conclusion seems to me clear that no prior devices or arrangements anticipated the patentees.

3. Does the defendant infringe? It was but feebly, if at all, insisted that, if the arrangement of devices by the patentees was entitled to be called invention, and was patentable, as above explained, the defendant did not employ its distinguishing features or characteristics. The details in the construction of his carbureter were not precisely like that used by the complainant, but those specific features were not claimed. The substantial operation of his carbureter and the mode of impregnating the atmospheric air are alike in both.

The difference between the apparatus of the defendant and that of the patentees chiefly relied upon is that, whereas the latter make the cavity below the ground a vault having surrounding walls, the defendant, having inserted his carbureter in the cavity, surrounds it with earth in direct contact therewith, and carries up to the surface a pipe through which to replenish the carbureter with oil, instead of having a removable opening to the vault below employed by the patentees.

The substance of the invention the defendant uses. The means of its effective useful operation are the same. The even moderate temperature of the earth, the underground passage of the gas, and the effect thereof are alike used in both. The difference in the construction of the carbureter used by the patentees, as described in the drawings, may make a more permanent opening about its sides desirable; but I cannot regard these details as of the substance of the invention. The apparatus of the defendant does substantially operate by the same means, in the same way, and to produce the same result.

The complainant must have a decree for an injunction and account in the usual form.

[*E. W. Stoughton* and *William Stanley*, for complainant.
Edmund Wetmore, for defendant.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From June 4 to July 5, 1875, inclusive.

BACKING ELECTROTYPES.—J. S. Brooks, Pittsburgh, Pa.
BAG FASTENER.—A. M. Miller *et al.*, Sturgis, Mich.
BESSEMER CONVERTER.—J. E. Fry, Johnstown, Pa.
BOTTLE STOPPER.—N. Thompson (of Brooklyn, N. Y.), London, England.
BOTTLE STOPPER, ETC.—N. Thompson (of Brooklyn, N. Y.), London, Eng.
BRAKE.—G. Westinghouse, Jr. (of Pittsburgh, Pa.), London, England.
COMB.—A. Poppenhusen, College Point, N. Y.
COTTON OPENER, ETC.—R. Kitson, Lowell, Mass.
CUTLERY.—J. W. Gardner, Shelburne Falls, Mass.
DOOR FASTENER, ETC.—E. C. Bacon (of Boston, Mass.), London, England
FIRE ARM.—J. D. Greene, London, England.
FRICTIONAL ELECTRIC BATTERY.—G. M. Mowbray, North Adams, Mass.
GAS STOVE.—J. L. Sharp, New York city.
GLAZING LEATHER, ETC.—R. Lee (of Phila., Pa), Huddersfield, England.
GRAINING LEATHER, ETC.—R. Lee (of Phila, Pa.), Huddersfield, England.
GRATE BAR.—F. S. Smith, New York city, *et al.*
HOT AIR FURNACE.—S. Smith *et al.*, Worcester, Mass.
LAMP REFLECTOR.—C. M. Murch, Cincinnati, Ohio.
LEATHER PULP, ETC.—B. James, Worcester, Mass.
LIFE RAFT, ETC.—J. Cone, Bristol, Pa.
LOOM, ETC.—T. A. Dodge, Cambridge, Mass.
MACHINE GUN.—W. B. Farwell, New York city
METAL TUBE, ETC.—G. J. Brooks, Brattleboro', Vt.
NUMERICAL TOY.—W. Rose, New York city.
ORDNANCE.—D. Davison, New York city.
PAVING COMPOSITION, ETC.—J. R. McClintock, New Orleans, La.
POISON VESSEL, ETC.—W. M. Caterson, Philadelphia, Pa.
POLISHING COMPOSITION, ETC.—F. Atwater, Norwood, N. J.
REAPING MACHINE.—Gammon *et al.*, Chicago, Ill.
RIVETING MACHINE.—J. F. Allen, New York city.
RIFLE TARGET.—J. G. Bennett, New York city.
WOOD SCREWS, ETC.—T. J. Sloan, New York city.
WRITING DESK.—W. S. Wooton *et al.*, Indianapolis, Ind.

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Recent American and Foreign Patents.

Improved Clothes Dryer.

Conrad Hauser, New York city.—The rod-carrying standard is made with folding legs that may be spread. The clothes-carrying arms are supported at different hight and direction in perforations of the standard, and may be readily inserted and taken out as required. A base plate above the folding legs is recessed with as many socket holes as there are rods, for seating one end of the same therein, while the other end is attached, by a suitable fastening device, to the standard.

Improved Joint Support for Street Railway Rails.

C. B. Sheldon, 7 State street, New York city.—This is a splice plate for rails laid on stringers, which is flanged on the under side to conform to the upper side of the stringer. The plate has elongated bolt holes, through which it is firmly bolted to the rails by bolts whose heads are countersunk in the bottom of the groove in the upper side of the rail, so as to hold the rail ends and the plates firmly together to prevent the spring of the rails up and down. By this plan the two rails are firmly bolted to the plate so that one cannot rise without the other.

Machinery for Beating out the Soles of Boots and Shoes.

Seth D. Tripp, Lynn, Mass.—This machine is contrived with a series of lasts for holding the shoes, which are slowly revolved upon a wheel to be presented successively to different smoothing devices, and so that the attendant may take the finished boot or shoe off the last and put on one to be finished while the last is passing; or if needful he may stop the machine while changing the shoes in case it is geared for quick motion. The machine is thus adapted for performing the work expeditiously.

Improved Sash Fastener.

Peter Meyer, Iowa City, Iowa.—This consists of a spring band, attached to the sash frame, and locking by a perforation on pins arranged at suitable distance on the window frame.

Improved Nut Lock.

Walter F. Marthens, Pittsburgh, Pa.—This invention is an improvement in the class of nut locks in which a spring pawl is pivoted to the nut, and engages with a rib or shoulder formed on the bolt to which the nut is applied. The arrangement is such that the spring will hold the locking plate engaged with the bolt, or disengaged from it.

Improved Governor.

William D. Marks, Chattanooga, Tenn.—The pendulum spindle is in two sections, of which the lower one, to which the driving power is geared, is capable of sliding lengthwise a little, at the same time that it turns the upper one. It also screws up and down in the hub of its driving wheel, and is connected to the wheel by a spring, which allows the wheel to overrun the spindle a little, and screw the spindle along when the motion increases to close the valve in advance of any change in the position of the pendulum. When the motion of the engine slacks, the tension of the spring causes the spindle to overrun the wheel, which will screw the spindle along the other way, and open the valve in advance of the changing of the pendulum, thus making a sensitive governor.

Improved Hay Rack.

Joseph Hall, Riverside, Neb.—This improved hay rack is constructed in such a manner that it can be taken to pieces and stored away when not in use, while it may be readily set up and placed on the wagon by one person. It consists of a bed frame, which is placed on the running gear of a wagon, and provided with vertical standards having detachable cross beams, and with inclined side and end ladders attached thereto, and load binding cords stretched by a windlass attachment.

Improved Valve Gear for Steam Engines.

Margaret V. Hewes, Newark, N. J., administratrix of Joseph L. Hewes, deceased.—The invention consists of a cut-off valve geared with the driving shaft by a compensating contrivance to cause the valve to gain on, and fall back of, the motions of the driving shaft at each revolution in the proportion of its variations with the piston by the effect of the different angles of the crank, and thus to cut off exactly alike for each movement of the piston.

Improved Draw Bridge Fastening.

Carroll J. Atkins, Louisiana, Mo.—Spring bolts are arranged on the draw, with sockets on the rests for these bolts to spring into when they come to holes. The bolts are connected by rods or chains with apparatus at the engineer's stand, whereby he may set them to spring into the holes at the proper time, and also to draw them out, to disconnect the draw when it is to be moved.

Improved Hog Trap.

John Murray Kimball, Wyoming, Iowa.—This trap is secured in a doorway of a pen, by means of the hooks attached to the outer side of the posts. The outer end of the lever is then raised to swing the lower end of a board outward, to open a space between boards wide enough for a hog to pass his head through. The hog is then driven to the trap, and as he passes his head through the said space the lever is lowered, swinging the lower end of the board inward, catching the hog by the neck, and holding him securely while being operated upon, a pawl taking hold of a notch in the lever, and preventing the board from being pushed outward by the struggles of the hog.

Improved Flooring Clamp.

James T. Moss and George J. Moss, Ashborough, Ind.—This consists of a fulcrum for the clamping lever of a flooring clamp, contrived to bear by a plate on the upper side of the joist, and another to bear on the under side. The parts of the clamp are connected by extensible plates, extending along one of the vertical sides of the joists, to adapt them for joists of different sizes, and to hold them so that they gripe the joists, and thereby hold fast on them when the lever is forced against the flooring.

Improved Mousing Hook.

Franklin G. Appley, Providence, R. I.—A band is placed on the shank to hold the hook to the shank and keep a shoulder in a recess in the shank. A lip on the band prevents a rope from catching in the angle, and a lug on the outer end of the hook keeps the ring from slipping off. To make the hook fast, the ring is turned half round, and is provided with a recess beneath the lip, which allows it to slip over a lug to release the hook.

Improved Wagon Brake.

Daniel L. Defibaugh, Bedford, Pa.—This construction enables the brake to be applied, when the wagon is so loaded that the ordinary brake lever cannot be operated, by a person in the rear of the loaded wagon, in which position he cannot be run over and injured, should he happen to fall.

Improved Heel Polishing Machine.

Leopold Graf, Newark, N. J.—The principal improvements combined in this invention include a cam that can be operated very quickly to fasten and release the work, also an eccentrically rotating slotted plate for turning the surface of the irregular or eccentric heel evenly and uniformly against the polisher, and finally a ratchet wheel and holding pawl, by which the tension of the spring which adjusts the heel forward or backward to the polisher can be increased or diminished at will.

Improved Paper Feeding Machine.

Socrates Scholfield, Providence, R. I., and Charles E. Baker, Mont Clair, N. J.—This is an improved device for raising the edge of the top sheet of a pile of paper from the sheet below, in order that the sheets may be successfully fed to a printing press or other machine a single sheet at a time. The invention consists in the combination of a lifting pin and a separate cutter with each other in such a way that the cutter may make a hole in the top sheet and rise to allow the pin to raise the edge of the sheet, and in the combination of a holder with the cutter and the lifting pin.

Improved Water Wheel.

Charles H. Sturges, Saratoga Springs, N. Y.—This invention consists of blades projecting radially from a vertical shaft in a case employed merely to conduct the water away. A series of jet pipes in the bottom of the reservoir above are inclined to discharge the water against the sides of the blades at little more than a right angle to the line of escape from the buckets. A gate in the reservoir is contrived to open the jets in succession, so as to regulate the amount of water by the number of jets. The invention also consists of a secondary set of jets discharging in the reverse direction, and contrived to be opened by the same gate when the others are closed, to reverse the wheel.

Improved Sofa Bedstead.

Axel Holmers, Boston, Mass.—This improved sofa or arm chair bed can be thrown open in such a manner that the seat or back of the sofa is not used at all for the bed, and consequently is less worn, retaining its form and appearance. The invention consists of four parts, two for the back and two for the seat, hinged together, to be swung open by disconnecting the arm top pieces from the arm braces, which form the legs of the front part of the bed. The sofa back and seat form the outer side, and a spring bottom the inner and bed part of the sofa bed.

Improved Planing Machine.

Henry C. Holloway, San Diego, Cal., assignor to himself and John S. Harbison, of same place.—This invention consists particularly in attaching angle plates to the slitting saws, whereby they are secured radially to the plane-carrying cylinder. This admits of convenient and quick adjustment of the saws along the cylinder, so that they may be caused to slit the stuff into pieces of any desired width.

Improved Watch Case.

Simon B. Simon, New York city.—This invention consists in making watch cases long and narrow or cylindrical in form, and of such a size that they may be carried in the pocket, worn in a lady's belt, or worn as an ornament or charm.

Improved Manufacture of Artificial Stone.

Luke W. Osborn, Morgan, and Edward D. Merriam and Peter B. Doty, Conneaut, Ohio.—This is a combination of sand, resin, brimstone, and coal tar, with or without oil and plaster of Paris, for the manufacture of artificial stone.

Improved Piano Tuning Pin Lock.

George P. Reeves, Helena, Montana Ter., assignor to himself and Charles Rumley, of same place.—This is an improved fastening device or lock for the tuning pins of pianos or other stringed instruments, for the purpose of rigidly holding the pin in position after the proper pitch of string has been adjusted by the tuner. The invention consists of an outer stationary and interior sliding jaw plate, placed around the tuning pin, and the conical wedge part of a locking pin or key, that forces the jaws around the tuning pin for binding the same firmly after tuning.

Improved Screw-Cutting Die.

Virginius J. Reece, Greenfield, Mass.—The object of this invention is to control the adjusting devices for the dies of screw cutters intended for cutting the full thread at one operation, so as to hold the dies firmly both on the outer and inner edges, and thus keep them perfectly firm and solid. The invention consists of taper-pointed screws between the dies to open them and regulate their distance apart, in combination with two taper-pointed screws screwing through the die holder against the dies, and holding them firmly thereto.

Improved Tool for Pivoting Watch Wheels.

Frank R. Bucklin, East Tilton, N. H.—This invention consists of a tube with a plug in one end, a handle in the other, a centering spindle in the center of the plug and handle, a cap for confining the wheel on the end of the plug, and an outside centering rod on an outside tube, all contrived for holding a pivot on the squared end of a post from which the pivot has been broken, so as to be soldered on readily.

Improved Machine for Tenoning Spokes.

Joshua R. Coleman and Samuel Myers, Galion, Ohio.—In this improved machine, the spoke is accurately centered in relation to the cutter head by means of angular clamping plates operated by right and left screw-threaded shafts. The jaws of the cutter head have angular faces, which bear upon the tenon, whatever be its form, at four different points, thereby supporting and steadying it under the action of the cutters. The crank shaft, which rotates the cutter head, works in the tubular stem of the cutter head, and a burr or screw collar determines their relative adjustment, and thereby the length of the tenon.

Improved Plow.

Augustus Griggs, La Fayette, Tenn.—The standard is framed to the rear end of the plow beam, and is made with an offset to rest against the lower side of the beam. The forward side of the standard is concaved from its shoulder to its point, to form a seat for the mold board. A cutter passes through a mortise in the beam, the mold board, and the standard, and is adjustably secured in place by pins. This acts also as a brace, to strengthen the standard against the draft strain.

Improved Gas Extinguisher for Street Lamps.

Lewis Boore, Buffalo, N. Y.—By suitable construction, when the pressure upon the gas is increased at the gas house above the amount to resist which a cup is weighted, the said cup will be forced upward, raising the lower end of a tube above mercury, and allowing the gas to pass through said tube to the burner. The tube is held down against the increased pressure by the catch, which is pivoted to a small bracket attached to the cover. As the cup and tube descend upon the decrease of the pressure, the edge of a flange strikes the catch, pushes it back, and passes below it. The said catch immediately swings forward over said flange, preventing the rise of said cup and tube until the said catch has been drawn back. When the time for lighting the street lamps approaches, the pressure upon the gas is increased to the desired point at the gas house. Then, as the lamplighter comes to each lamp post, he pushes back the catch, and, as the tube and cup rise with the pressure, he lights the escaping gas. When the time for putting out the lights arrives, the attendant at the gas house reduces the pressure to the proper point, and all the lights in the street lamps are put out at the same time.

Improved Grain Drill and Planter.

Henry Reutchler and Elias M. Morgan, Belleville, Ill.—A pivoted yoke straddles an eccentric on the axle of the truck, and imparts its own vibratory movement to a rock lever, which reciprocates the grain dropper through the medium of the ordinary connecting rod. The invention also includes certain devices for attaching the truck to the axle and preventing its rotation.

Improved Ice Cream Freezer.

John W. Condon, Baltimore, Md.—This invention relates to certain improvements in ice cream freezers, and it consists in the combination with the top plate of the freezer of a flange to extend over and protect the teeth of the gear wheel upon the cover of the cylinder from the particles of ice, salt, and other obstruction. It also consists in a single coupling collar, which slides laterally and couples or uncouples the actuating shaft of the driving wheel and the shaft of the pinion that operates the freezer cylinder.

Improved Heel-Polishing Machine.

William Westcott, Syracuse, N. Y.—This invention relates to certain improvements in machines for polishing the heels of boots and shoes, and it consists of a branched frame which carries the shoe-holding devices, which frame is located just beneath the polishing tool, and is pivoted upon horizontal pivots to a vertical rod, which is attached to the frame work by a swivel joint, and is held up by a spiral spring. In one end of the branched rod is an adjustable spring-seated rod, regulated by a cam and set screw, which said rod enters a socket of the last and presses the heel of the shoe against a pivoted plate. The invention also consists in the combination with the shoe-holding devices and the branched frame of a hand lever and pawl for withdrawing the shoe from the polishing tool, and in the peculiar construction of the polishing tool, in which a soapstone block is provided with side plates, to which the support is pivoted to prevent wearing the said block.

Improved Telegraphic Circuit.

William E. Sawyer, Washington, D. C.—The main principle of this invention consists in a division of the transmitting battery current, and the placing of that battery at the receiving end of a line. The result of this application of electric force is not to free a line of tailings or the attenuation of impulses transmitted, which may exist to any degree in the line wire, but to prevent those tailings or attenuations of impulses from producing any effect upon the instrument. In order to produce or cut off action, or discoloration of chemical paper, in the receiving instrument, it is only necessary that the closing of the circuit at the transmitting end of a line shall set the current from the battery at the receiving end to dividing and a part of it flowing in the direction of the transmitting end. It is not necessary, therefore, that an impulse shall ever reach the transmitting end. It is not necessary that the current shall travel any distance upon the line wire, but that we reduce the potential of current acting upon the receiving instrument; and to reduce this potential, it is merely necessary that the current shall begin to flow by divisions toward the transmitting end.

Improved Bale Band Tightener.

John L. Sheppard, Charleston, S. C.—The object of this invention is to provide a device, to be used in connection with baling presses, for the purpose of tightening the bands upon the bales when the latter are being prepared for market. It consists in a large roller journaled in a frame attached to the baling press and driven continuously by power applied through a band and pulley. Journaled in frames by the side of said large roller are a number of smaller rollers, whose peripheries touch that of the larger one. Said smaller rollers are journaled eccentrically in secondary bearings, which latter are also journaled in the framework. To said secondary bearings are attached lever extensions, by means of which the pressure of the smaller roller upon the larger one may be regulated.

Improved Bob Sled.

John J. Sandgren, Ironton, Wis.—This is an improvement in bob sleds with separately moving and adjustable runners, that adapt themselves to the unevenness of the ground. The invention consists of the connection of the runners with the lateral beams by suitable pivot joints, and the lateral brace connection of the runners with the tongue and reach.

Improved Carpet Cleaner.

David B. Scofield, Baker City, Oregon.—In using the apparatus, a small quantity of very hot soap suds, to which may be added a small quantity of other ingredients used for removing grease and dirt, is drawn up into the lower part of tube. The lower end of the tube is then placed upon the carpet over the spot to be cleaned, and a piston is worked up and down below a valve, forcing the suds into and drawing it out of the carpet until the grease or dirt has been removed. The piston is then worked above the valve to draw the suds out of the carpet, a sponge preventing the suds drawn out from flowing out through the lower end of the tube, and the valve preventing it from being forced out by the descending piston. In this way the suds can be drawn out so thoroughly that the wet spot will readily dry.

Improved Oil Can.

Gouverneur K. Haswell, assignor to himself and Charles H. Haswell, Jr., 6 Bowling Green, New York city.—This is a can or other oiler, in the nozzle of which is a valve to shut off the escape of oil and prevent waste, having a spring for closing it, and connected by rods and a lever with a thumb piece upon the outside. The invention also consists of a vent hole, in connection with one of the connecting rods and a stopper on the rod, so contrived that the vent opens and closes with the valve. The oil spout is constructed in sections, one of which has the upper end contracted sufficiently within the base of the next section, which is fitted on it, to form a rest for the spring which closes the valve, and another has its top similarly contracted to form the seat for the valve.

Improved Baling Press.

John C. Stokes, Villanow, Ga., assignor to himself and Joseph W. Cavender, same place.—This invention has for its object to improve the construction of the baling press for which letters patent were granted to the same inventor November 24, 1874. By suitable construction, as the shaft is turned in the direction to wind up the rope and raise the follower, other ropes will be unwound, allowing the outer ends of levers to drop outward beneath plates by their own weight, so that the follower may be free to rise. As the shaft is turned in the direction to wind up the ropes, the upper ends of the levers will be drawn inward; and as they approach the vertical position the levers will act as toggle joints, and press the follower downward with immense power.

Improved Turbine Water Wheel.

James M. Denson, Columbus, Va.—This invention is a turbine water wheel provided with a rotary upwardly-movable gate, inclosing and covering the chutes or water ways. The gate may be raised or lowered to any desired hight along the wheel, according to the power required.

Improved Children's Swing.

George A. Fanjoy, Williamsburgh, N. Y.—This invention consists in an elastic back for a swing seat, made of a strip of hard elastic wood, bent into proper form, and having a strip of metal attached to its outer side. There are also straps designed to be passed between the child's legs, to keep him from slipping off the seat forward. The back is connected with the rear and side edges of the seat by other straps so as to be flexible, to allow the back to be drawn together to fit the child.

Improved Plow Colter Cleaner.

Theodore Wallis, Scipio, and Oscar J. Case, Auburn, N. Y.—As the plow moves forward, an arm moves forward and back along the cutter, and pushes off any grass, weeds, stubble, or other rubbish that may lodge upon it.

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Notes & Queries

A. J. R. will find directions for preparing liquid glass (silicate of soda) on p. 225, vol. 23.—R. K. is informed that making malleable iron castings is described on p. 138, vol. 29.—R. F. will find a recipe for cement for china on p. 346, vol. 24.—F. C. will find directions for enameling iron saucepans, etc., on p. 149, vol. 28.

(1) E. G. T. says: I have a small telegraph apparatus for learners, consisting of a key and sounder, the current being obtained from a simple battery of zinc, copper, and blue and white vitriol. How could I make it work an electric light? What material would be required, and how should I arrange it? A. See p.35, vol. 33.

(2) W. C. asks: 1. Which will be the stronger of the following? Three cells of Bunsen, zincs ⅛x6x14 inches, carbons ¾x2x9 inches, porous cups 8 inches high, 3 inches diameter, and $\frac{4}{16}$ inch thickness; or a Grenet battery of 8 cells, zinc plate ¼x2x4½ inches, and carbon plates ¼x2x4½ inches? A. On short circuit, the Bunsen. On long circuit, the Grenet. 2. Can the electric light be produced with one of the above batteries? A. Yes, with either. Use 50 cells Bunsen or 100 Grenet. 3. Is the middle plate of a Smee cell sometimes made of carbon? If so, is it as good as the silver coated with platinum? A. Yes. 4. Where can I find directions for making induction coils? A. On p. 219, vol. 32.

(3) E. G. S.—There would be no action in a battery of zinc only, arranged as you propose.

(4) A. B. says: I have a telegraph line of ⅛ of a mile in length, with two relays on it made of No. 24 cotton-covered copper wire, 1 lb. of wire in each relay. The battery is of the Lockwood and Callaud pattern, six jars each. The current is strong enough to produce a very disagreeable sensation on the tongue when it is placed between the wires of the main line. The relays will not work with sufficient force to operate the sounder that is attached to the local battery. One jar of the local battery will work the relay on a 2 foot circuit very well; but if I put my tongue between the wires of the local battery, I cannot discover any current passing. What is the matter with the relays, and what shall I do to make them work? A. Do you use a ground for a return wire? If so, try another wire in place of the ground.

(5) A. G. Jr. says: In *Science Record* for 1873 some one recommends chromium as a negative metal in galvanic couples. I see in the market lead plates, covered with a film of what purports to be chromium, and apparently coated by deposition. If chromium can be so deposited, what salt of the metal is there that can be used? A. The chromium is not deposited upon the lead electrically, but is pulverized mechanically, and then pressed into the lead.

(6) G. H. says: Can a lightning rod lose its properties as a conductor, after standing 7 or 8 years and becoming considerably tarnished from exposure? Is it more dangerous to use such a rod than none at all? I ask these questions because our factory was recently struck by lightning, the electricity leaving the rod after passing down a short distance and entering the building, where it expended its force among a lot of iron castings, which lay upon the floor directly opposite that part of the wall to which the rod is attached. Its action upon these castings is shown by small spots, where the iron seems to be eaten as if by some acid, though the roughened surface is somewhat brighter and looks as if a small quantity of molten tin had been dropped there. I cannot find that the fastenings of the rod are out of order, and therefore wonder why the electricity should leave it, unless its conducting qualities are impaired. Would repolishing the rod restore its officiency? A. The age of the rod would not affect its usefulness, unless the joints had lost, by rust, their conducting power, or the rod was diminished in size by rust. We would be glad to have you examine the portion which goes into the earth, and let us know whether it is still perfect, how deep it runs into the ground, and what the condition of the earth about it is in regard to moisture: also whether the rod contains any joints, or whether it is one continuous rod. What metal is the rod composed of?

(7) G. B. asks: Of what shape must I construct a magnet in order to gain the most power? A. Of horseshoe shape. 2. What power can be got per square inch? A. This is proportional to the size and number of turns of the wire and the strength of the battery. 3. What ratio does the power diminish as the distance is increased? A. As the square of the distance.

(8) J. M. says: I tried to make ground connection by taking two pieces of sheet tin, 1½ feet square: I soldered copper wire to them and buried in moist earth, about 3 feet in ground, and it would not work with about 100 feet of wire. What is the reason? A. Your plate was too small. 2. I made a battery in the following manner: 1 quart jar with coil of copper in bottom, and a zinc fitting the jar, with hole in center and suspended along the copper, with wire attached. A wooden cup was put in the jar with holes in the bottom for the blue vitriol. I let it stand about 4 hours, and it gave a current. Is such a battery in use, and what do you think of it? A. Your battery is a modification of the Daniell. We cannot see that it has any peculiar merit. 3. How is the electric light made? A. See p. 35, vol. 33.

(9) W. R. D. asks: 1. What is the most practicable method of electrotyping by means of zinc? A. See p. 405, vol. 32. 2. How is silver platinized? A. By an electrotype process.

(10) M. D. asks: 1. What size of objective and eyepiece would suit a tube 4 feet long? A. The size of the object glass depends on its approach to perfection. When achromatic and of the proper curves, it may be 3 or 4 inches in diameter for a tube 4 feet long; but the only way, and that followed by all astronomers, is to try the glass, and, if it is not satisfactory, to reduce the size with diaphragms until a sharp image is obtained. 2. How can the object and eyepieces be neatly and correctly attached? A. Neat and correct mounting can only be done by turning the tube on the lathe, as the glasses have to be perfectly centered, which means that the optical center of the curve must coincide with the axis of the tubes, and this is of primary importance. Of course the focal length of the object glass must be a little less than the length of the tube; while that of the eyepiece may be shorter, in proportion as the object glass is better in quality. An inferior objective can bear only a weak eye glass, that is, one of long focus. 3. What is an approved elementary treatise on astronomy? A. Herschel's "Astronomy," published by Appleton, is one of the best.

(11) H. P. T. asks: Is there anything gained in a Callaud or gravity battery by covering the zinc with unsized paper? Does it reduce the working strength of the battery? In case of accidental disturbance and mixing of the solutions, does it prevent the deposition of copper upon the zinc? I find after long use that the paper is covered here and there with crystals of copper; but upon removing the paper I cannot see any trace of copper upon the zinc. A. If the gravity battery is properly put together, so that the fluids do not mix, there will be no local action. The paper will do no harm and not much good.

(12) A. B. says: I have been trying to invent a process which would assimilate circles to right lines, in other words, to do away with the tedious process of referring numbers to logarithms and back again in ordinary trigonometrical calculations. My idea is to do away with degrees, minutes, and seconds in the circle, and to reduce all parts to decimals. Therefore I propose that the circumference of a circle shall be 1,000 or 10,000 or 10,000,000, and all the parts correspond in decimals. Is this practicable? If not, why? A. This method is practicable, and was used in the beginning of this century in France, when attempts were made for a thorough introduction of the decimal system, making a day 10 hours long, the week to 10 days, etc. At that time tables were calculated and published, in which the quadrant of the circle was divided into 100 degrees, the degree into 100 minutes, the minute into 100 seconds, so that the quadrant was divided into one million parts; but it met with no favor, as the natural division of the circle is into 6, which is no divisor of 10. Your system is worse, as dividing the whole circle into 1,000 parts gives 250 for the quadrant. If you study thoroughly the use of logarithms in trigonometrical calculation, you will see that it would be a retrograde step to do away with them, as they simplify the calculations enormously, and admit of a great saving of time. You will need your tables of sines and tangents just as much without logarithms as with them, and without them no trigonometry is possible. You may calculate them for decimal degrees, but the change does not amount to much, and does not involve any fundamental principle, as they cannot be dispensed with.

(13) A. K. says: 1. In constructing a small electromagnetic motor, in which two electro-magnets cannot be successfully applied, I intend to substitute one of them by a well magnetized iron bar. Will said bar magnet, working on a pivot in such a manner as to bring one of its poles in contact with a pole of the electromagnet, be attracted and repulsed regularly whenever the poles of the electro-magnet are changed, or will it lose its polarity after a while and be attracted by a negative as well as a positive pole? A. Iron will not retain magnetism. 2. Will the repulsion be of the same power as the attraction? A. Yes. 3. Will an oblong-shaped core answer instead of a round one, as commonly used for electro-magnets? A. Yes.

(14) D. R. S. says: Please give me minute details of how to make and mount a telescope, such as is used on rifles for long range firing. A. We would not advise you to try to make such a telescope unless you are an optician. The lenses generally used for this purpose are made and mounted in France, and it is difficult to compete with their makers as to quality, and impossible as to price. A tube about one foot long is required, and attached to it are a French objective at one end, and a sliding eyepiece at the other end.

(15) H. E. asks: 1. Can a field or marine glass be obtained that will enable an observer to recognize the face of a person at a distance of two miles? A. No field glass can have that power; a large astronomical telescope is needed for this purpose. 2. Can a binocular telescope accomplish this? A. A binocular telescope is necessarily of limited size; but if long enough, it will serve the purpose a little better than a single one.

(16) W. C. M. asks: 1. On what principle is the Baumé hydrometer constructed? We tested a sample of oil with five hydrometers, and they all showed differently. A. There are four kinds of hydrometers. The first is that of Baumé, which must indicate zero in pure distilled water in relation to liquids heavier than water, and 10° in relation to liquids lighter than water. In the second kind, the specific gravity of distilled water is assumed at zero in both scales, either for heavy or light liquids. This is adopted in the *Pharmacopœia Batava*. The third is that of Cartier, which is like that of Baumé except that the degrees are larger, every 20° of Cartier being equivalent to 22° of Baumé. The fourth is the centesimal hydrometer of Gay Lussac, which is made for use in alcohol only. To test any of these hydrometers for accuracy, without having a recognized standard to compare them with, requires a hydrostatic balance. Baumé for heavy liquids must indicate zero in distilled water of 60° temperature; and in a salt solution, of 1·16 specific gravity and at the same temperature, it must indicate 20°. Baumé for light liquids must indicate 10° in distilled water, and 30° in a mixture of water and alcohol, of a specific gravity of 0·88. The hydrometer of the *Pharmacopœia Batava* for heavy liquids must indicate the same as Baumé, but that for light liquids must show zero in distilled water and 20° in the mixture of water and alcohol of 0·88 specific gravity. In Cartier's hydrometer, the specific gravities mentioned must correspond with those of Baumé *minus* 2° nearly, that is, the indications of Cartier are nearly 2° less for every 20°. Gay Lussac has based his alcoholometer on the principle of placing zero for water and 100° for absolute alcohol, while 100° corresponds with 44° of Cartier, and 47° of Baumé. Half alcohol and half water, having a specific gravity of 0·917, must correspond with 23° of Baumé, 13° of the *Pharmacopœia Batava*, 21° of Cartier, and 56° of Gay Lussac. It will be seen that this testing is troublesome, and it is best to procure a reliable standard to compare your hydrometers with.

(17) L. D. T. asks: 1. What is the best way to build a brick cistern, so as to filter the water perfectly? A. See p. 362, vol. 32. 2. How deep does an 8 foot diameter cistern want to be to hold 100 barrels water? A. About 12 feet.

(18) W. L. says: 1. We keep water up stairs to use in case of fire, but it has to be changed often. What can be put in to keep it from smelling bad? A. It will be better to continue to change. 2. The steam pump draws the water now from the well, about 18 feet, with a 2½ inch plunger of 10 inches stroke, running at 62 per minute. Flow of water is about 208 feet per minute, through iron pipe 1¼ inches in diameter. The pipe is large enough to keep tank full of water, and sometimes we have to shut off to keep from running over. If we should lay 1¼ inch iron pipe to the river, down a gradual descent of about 16 feet, then down to bottom of river 8 feet, making in all about 24 to 25 feet raise, and about 360 feet in length, will it work well? A. Yes, if properly laid.

(19) M. T. W. says: Can you give me a formula for making a cheap concrete of lime, sand, cement, or any other suitable material that will pack in an inch space between planks 2x4 inches, and resist the action of heat, cold, and the atmosphere? A. In France, asphalt is extensively used for this purpose, especially where the plank is laid on the ground, for cellar floors, etc., in which case no sleepers are used.

(20) A. H. asks: I have a kitchen 14 feet wide, with shed roof. The roof has 2 feet fall, and is slanting. Whenever we have a heavy rain, the water stops on it and comes through very badly. Is the roof too flat? A. Your roof is too flat for shingles. You had better raise it so as to give it a steeper pitch. Six inches to the foot is little enough.

(21) J. E. D. asks: Is there anything that will cut shellac except alcohol? A. Shellac is soluble in a hot solution of borax in water.

(22) E. H. asks: What is the best method of obtaining free gold from the ore? It is very soft, mined with pick and shovel only. A. First crush the ore very finely, mixing it water by agitation, and allowing it to run over a short inclined plane composed of sheet copper, the surfaces of which have previously been evenly colored by a film of mercury which adheres strongly to it. Through the strong affinity existing between the two metals (gold and mercury), the particles of the gold are arrested by the quicksilver, while the other substances accompanying it pass by without hindrance. The alloy of gold and mercury formed may be decomposed by placing it in an iron retort, the beak of which, or its connection, dips beneath the surface of some cold water in a suitable vessel. On the application of a strong heat to the retort, the mercury is vaporized, and, distilling over, is condensed beneath the surface of the water, while the gold remains behind in the retort. The above is one of the best methods in use; but if the gold is required in a very pure state, the following process may be employed: After finely crushing the ore, subject it to the action, for some time, of a hot mixture of muriatic and nitric acids, 3 parts of the former to 1 of the latter. To this solution, after decantation from the undissolved residue, add a strong solution of copperas in water, until no further precipitate forms. Allow to subside and decant the supernatant liquid. The precipitate consists of the pure gold in a minutely divided condition, to which, alone, its dark color is due. An excess of acid in the above operation should be particularly avoided, as it will only redissolve, in part, the precipitate formed on addition of the iron salt.

(23) L. C. T. asks: You recently gave me a recipe to form tannate of gelatin inside a keg. Please tell me the quantity of gelatin by weight to use to 3 quarts water, and the quantity of tannin by weight to 1 quart water? A. Use about 1¾ lbs. gelatin to 3 quarts water, and a saturated solution of tannin. 2. I presume the gelatin is a fine form of glue, and not that used for pastry purposes. A. You are right.

(24) C. C. & B. ask: What kind of stamping ink will not smear when used on leather glazed with oxalic acid, glue, and white of eggs? A. Try a strong solution of copperas in water.

(25) G. A. B. asks: 1. What kind of acid is used in soldering, and how is it prepared for use? A. Add zinc to a small quantity of muriatic acid, until no further solution takes place. 2. What kind of copper is used for making soldering tools? A. Ordinary copper, carefully tinned. 3. Is there anything better than copper to make soldering tools of? A. No.

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(26) J. F. B. asks: How can I make olefiant gas? A. The gaseous products of the destructive distillation of the fatty or so-called fixed oils and resins are very rich in elayl gas (olefiant gas). As oils yield further only a small quantity of carbonic acid gas, and no sulphuretted hydrogen, oil gas does not require any purifying, and hence the apparatus may be very simple; while, owing to the high illuminating power, smaller gas holders, smaller pipes, and burners of different construction are required. One pound of oil yields 20 to 25 cubic feet of gas, equal to 90 or 96 per cent.

(27) A. W. C. asks: Is there a remedy to prevent verdigris forming on copper cartridges when carried in the thimbles of a belt? A. Dip them for a moment, when clean, in an alcoholic solution of shellac. Allow them to dry completely before placing in the belt.

(28) S. W. S. asks: What is aluminate of soda? A. It is now prepared on a large scale, as it has been found a very useful form of soluble alumina, especially in dyeing and calico printing. The preparation of this compound is based on the solubility of hydrate of alumina in caustic potassa or soda lye, and the ready decomposition of the solution by carbonic and acetic acids, bicarbonate and acetate of soda, sal ammoniac, etc. The compound is generally formed by calcining either cryolite or bauxite, minerals containing a large per cent of alumina, with carbonate of soda, in a reverberatory furnace. It may be obtained on a small scale, by boiling alumina with caustic soda lye for some time.

(29) J. R. asks: What are the drawbacks, if any, to the use of gasoline as an illuminating agent, as applied for that purpose in the automatic gas machine? A. They are mainly due to the dangerous character of the materials used; gasoline, naphtha, and similar volatile hydrocarbon oils. The vapors arising from these oils, being heavier than the air, have a tendency to accumulate in pools on the floors of the cellars or vaults where the oils are used, and becoming mixed with the air form a terribly explosive mixture, the ignition of which, from the careless dropping of a partially extinguished match, or flame of any kind, is often sufficient to destroy the building.

(30) R. R. Z. says: 1. You speak of a glaze or enamel called boro-silicate of soda. How is this made? A. Melt together pulverized felspar 27 parts, borax 18 parts, sand (fine, white) 4 parts, potash, niter, and potter's earth, 3 parts each. Then add 3 parts of borax reduced to a fine powder, also fine black oxide of manganese in the proportion of 48 grains oxide to 6 lbs. of the enamel. When fully fused, throw into cold water, and then remelt and again quench in water, as before. Repeat this until the enamel is fine and white. It is then ready for use. 2. Will it stand the action of hot 66° sulphuric acid? A. Yes.

(31) J. O. F. asks: What is the latest and most approved plan of tempering small springs? A. There is nothing better than dipping them in oil and blazing the oil off.

(32) M. W. H. asks: 1. Will tool steel make good steel springs? A. No; it is apt to break. 2 What kind of steel is best for springs? A. Spring steel. 2. Can springs be tempered in water or oil, so that they will be tough and limber? A. Yes; harden in water, temper with oil.

(33) W. H. C. asks: What is the best way to join a band saw? A. Braze it, taking care to hold the ends true.

(34) P. J. M. asks: What is the best means to secure a good casting, free from blowholes and defects, where you are obliged to cast into it some pieces of wrought iron, as done in a fly wheel with cast rim, wrought iron arms, and cast iron hub? A. Heat the wrought iron, and have a good dry mold, casting endwise whenever possible.

(35) J. S. M. asks: 1. Does it take more power to run beveled gears than it does to run spur gears? A. There is no practical difference. 2. Can you tell me the best way to find the proper size of a hole (in a face plate, for instance), in which a thread is to be cut? I have heard that it is best to measure the outside of the thread of the screw; and if it is 10 to the inch, the hole should be bored 1½ tenths = $\frac{3}{20}$ less, which will give a full thread to match. If the thread is 12, 1½ twelfths is right, and so on for every number of threads. A. We have never heard of the rule you give. Try it, and let us know the result.

(36) E. E. K. asks: Can india rubber valves which have been used in hot and cold water pumps be remolded for the same use? A. No.

(37) J. C. G. says: I have a grindstone 3 feet in diameter and of 5 inch face, that seems a great deal too hard for sharpening tools for working in wood. How can I soften it? A. Your only method is to keep water running over it, which will partially soften it.

(38) B. K. D.—If your self-operating water elevator only costs $2.50, you can very readily test the question of demand by putting it on sale.

(39) H. G. S. asks: On a gravestone of fine Italian marble, the engraver inadvertently cut a superfluous comma. How can I fill it in so as to be permanent, and show as little as possible? A. We can think of nothing better for the purpose than plaster of Paris, mixed with a small quantity pulverized mica.

(40) R. says: I have tried many of your ink recipes, and send you an improvement on one which I found in the SCIENTIFIC AMERICAN, and used many years ago. Black ink: No. 1. Take powdered cloves ½ oz., extract logwood 2 ozs., hot water 1 gallon; dissolve. No. 2. Take bichromate potash, powdered Prussian blue each 120 grains, prussiate of potash 80 grains. Dissolve in 1 pint warm water, then mix No. 1 and No. 2 together. The Prussian blue is the improvement; it flows freely and dries quickly. Sugar will spoil it. I have not known it to gelatinize or mold.

(41) M. M. says, in reply to C. P. B., who is troubled by sparks flying from the top of his chimney: There is a much better way to stop the evil than by the use of a screen. So arrange your flue that the draft shall be projected downward into a short chamber, of about 5 or 6 times the sectional area of the chimney flue. From this chamber, let the draft enter the chimney. The current of smoke passing through this chamber will be so slow that nearly all the dirt will settle out of it. If the bottom of the chamber is kept flooded with water, no dirt whatever will pass out of the chimney. I have seen a chimney, that was a complete nuisance to the whole neighborhood, made perfectly clean by the above plan. The draft will not be affected perceptibly. The draft might pass from the side of the chamber to the chimney, but it should be near the opposite end from where it enters.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. P. L. R.—No. 1 is decomposed sandstone containing scales of mica. No. 2 is a white clay. No. 3 is a fossiliferous stone containing a large percentage of lime. No. 4 is celestine. No. 5 is a variety of hard fine grained sandstone. Specimens of New Jersey green sand can be obtained from Dr. G. H. Cook, State Geologist, New Brunswick, N. J.—O. C.—Send us a sample of your oil, and we will endeavor to help you.—A. B. L.—A qualitative analysis was made of your samples. No. 1 contains sulphide of lead and iron. No. 2 contains sulphide of lead, iron, and quartz and No. 3 is quartz and sulphide of iron. No. 4 is sulphide of iron with traces of arsenic. No. 5 is sulphide of iron and quartz. We do not consider them of much value. You will find the cost of working these mines too expensive, as fully 70 per cent of the minerals is quartz.—M. A. B.—They are the wings of red mites, sub-order *ascarina*.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Cure for Toothache.. By E. D. P.
On the Keely Motor. By J. R., by L. W. S., by J. W. C., by L. K. Y.
On Mechanical Motors. By J. E.
On the Chemical Firefly. By C. W. W.
On the Potato Beetle. By O. E. D., and by J. G.
On the Iron Horse. By F. H. R.
On the Cincinnati Exposition. By J. C. B.
On Dental Surgery. By ——.

Also inquiries and answers from the following:
J. E. W.—L. G. F.—R.—W. B. H.—M. O. H.—P. O'N.—H. F. N.—J. W. C.—T. H.—A. W. & Co.—J. M. T.—W. J. P.—J. E. C.—S. C. M.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells Baumé hydrometers? Who makes field glasses and binocular telescopes? Who sells apparatus for making olefiant gas? Who makes rag boilers for paper makers' use?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,452.—WRITING PAPER.—H. D. Cone, Stockbridge, Mass.
8,453.—COFFIN PLATES.—W. Parkin, Taunton, Mass.
8,454.—TYPE.—J. Herriet, New York city.
8,455, 8,456.—NUBIA.—J. Phipps, Philadelphia, Pa.
8,457.—CARPETS.—T. J. Stearns, Boston, Mass.
8,458.—STOVES.—J. VanWormer *et al.*, Albany, N. Y.
8,459.—STOVE.—N. S. Vedder, Troy, N. Y.
8,460 —STOVE.—A. Wemyss, Philadelphia, Pa.
8,461.—EMBROIDERY.—E. Crisand, New Haven, Conn.
8,462.—COOK STOVE.—J. Dwyer, Detroit, Mich.
8,463.—TYPE.—W. W. Jackson, Philadelphia, Pa.
8,464, 8,465.—GLASSWARE.—J. B. Lyon, Pittsburgh, Pa.
8,466.—TOY BLOCKS.—S. Lyman, Leominster, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade mark $25
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On issuing each original Patent $20
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On application for Reissue $30
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, July 7, 1875.

4,950.—C. Dean, Crowland, Ont. Radiator for boiler flues. July 7, 1875.
4,951.—J. A. Wilson, Chester, Vt., U. S. Clothes wringer and bench. July 7, 1875.
4,952.—W. W. Price, Petitcodiac, N. B. Lantern and dinner kettle. July 7, 1875.
4,953.—T. Elliott, Smith, Ont. Hay rake and loader. July 7, 1875.
4,954.—C. G. Force, Jr., Cleveland, Ohio, U. S. Arches for sewers and for other purposes. July 7, 1875.
4,955.—Wm. Abercrombie, Hamilton, Ont. Door-relishing attachment. July 7, 1875.

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Advertisements.

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Inside Page - - - - - - - 75 cents a line.

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SAFETY VALVE TESTS.

The Board of Supervising Inspectors of Steam Vessels, at its last annual session in January, 1875, appointed a committee to make an experimental test of all Steam Boiler Safety Valves which may be submitted for examination, and which are believed to embody principles of action superior to those of the safety valve in common use.

The valves presented must have a uniform area of opening of *five* square inches (2 525 inches diameter), and will be submitted to the following competitive examination:

1. Capability of discharging any excess of steam above a fixed working pressure.
2. The limits of pressure within which the valve will open and close.
3. Uniformity of action at different pressures.
4. Reliability of action under continued use.
5. Simplicity of arrangement and facility of management.

The valves will be tested at a pressure not less than *twenty*, nor more than eighty, pounds to the square inch, and are not required to be provided with an enclosing case.

All valves must be operated by the pressure of the steam; and the greatest diameter of opening for double seated valves will be the same as for single-seated valves.

The flange for attaching to boiler must be *eight* inches diameter—flat face, without bolt holes.

The proposed tests will be commenced on the thirteenth day of September, 1875, in the city of Washington, and all valves submitted must be boxed and sent by express (charges prepaid) to "Commodore P. H. Patterson, Commandant of the Navy Yard, Washington, D.C.," marked "Safety Valve," and enclosed with each valve will be communication addressed to the Committee of Examination, setting forth what superiority is claimed for the valve herewith submitted, and signed by the person presenting the same.

All valves must be delivered on or before the sixth day of September.

A single representative for each valve will be admitted to witness these tests, on application to the subscriber.

WILLIAM BURNETT,
Supervising Inspector General,
Treasury Department, Washington, D. C.

A SELF-ACTING TRAP—To Rid out all Rat and Animal Creation. Agents wanted. No trouble to sell. Address JOHN DILDINE, Limestoneville, Montour Co., Pa.

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Builders of the YALE VERTICAL the *best* and most *Economical*, either for land or marine use; also HORIZONTALS, with or without the *Rider* Cut-off.

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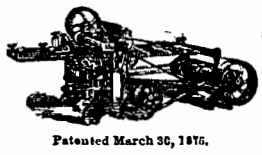
Buffalo Excelsior Pony Planer & Matcher



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CLARK & CO'S SELF-COILING ROLLING STEEL SHUTTERS (Burglar Proof), For Store Fronts and Rear Windows, require no machinery or balance weights, and can be applied to any opening; also Rolling Wood Shutters for Stores and Dwellings. Thousands are in daily use, and are acknowledged the best shutters in the world. Send for Catalogue to JAMES G. WILSON, Manager,
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The only Air Compressor that will give a pressure o 25 to 500 lbs. pressure of Air or Gases to the square inch WITHOUT HEATING, with 25 *to* 50 *per cent less power* than any other Air Compressor in the market. EVERY MACHINE WARRANTED TO RUN PERFECTLY COOL AND GIVE ANY PRESSURE DESIRED. No Water Jacket required around Pump. Valves of Metal. No chance to burn or stick. State amount in cubic feet of air per hour desired and the maximum pressure required, and we will furnish price, &c. Address THE BOWERS AIR COMPRESSOR CO., 118 Main St., Louisville, Ky., or New Albany, Ind.

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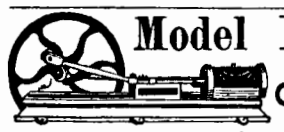

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Complete sets of
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Engine Lathes, Planers, Upright Drills, Hand and Chucking Lathes, Boring Machines, and other tools of heavy weights, first class stock and workmanship. Prices to suit the times. Send for Illustrated Catalogue.
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☞ Headquarters for any thing in the Hardware line.

WE can sell these First-Class Pianos for Two Hundred and Ninety Dollars, because we employ no agents and allow no discount to dealers—they swindle you out of more than twice the real cost of all Pianos. During the past 7 years we have sold our Pianos to over 1,000 families, in every section of every State and Territory in the Union. There is not a county, or a prominent town where they are not in use, and hundreds of small towns everywhere also have them. If you will send for our Catalogue, containing 15 solid columns in fine type, of the names and residences of prominent citizens, including members of Congress and many influential and wealthy bankers and merchants everywhere, who are using our Pianos—you will be sure to find some of them at your very door, in your own or some adjoining town, where you can see and try our Pianos.

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We are a responsible incorporated company, and refer by permission to the Chemical National Bank of New York City, which any Bank in the United States will satisfy you is by far the strongest Bank in America. We make this statement to prove that our 5 years' warrant guarantees our Pianos to be fully equal to any Piano in the world at any price

PRICE $290.
U.S. PIANO CO. N.Y.
STURTEVANT HOUSE,
New York,
Sept. 15, 1874.
TO WHOM IT MAY CONCERN.—We have used the U. S. Pianos for the past six years.
We have two of them in our public parlors.
In our opinion there is no Piano more durable or possessing superior musical qualities.
LEWIS & GEO. S. LELAND.

Please write us, and you will receive not only our Illustrated Circular containing full particulars, but also a written reply to all questions from some officer of our Company in person. Please state where you saw this notice.

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Awarded a Bronze Medal at the American Institute Fair for 1874. The Judges say: "We consider this method of fastening DOOR KNOBS a great improvement over anything yet invented for the purpose, as it obviates the use of side screws and washers, and can be regulated to suit any thickness of Doors." Send for Circular.
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MANUFACTURERS OF FIRST CLASS STATIONARY ENGINES, 8 to 100 H. P., PORTABLE ENGINES, CIRCULAR SAW MILLS, STEAM BOILERS, ROTARY BOILERS, MILL AND FACTORY MACHINERY, &c., BUILD GRIST MILLS, guaranteeing 80 BARRELS FLOUR WITH ONE TUN BEST COAL, or **50 Barrels Flour with One Cord Best Wood**; also, Engines to run on 3 lbs. coal per hour per indicated horse power.
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IRON & WOOD WORKING MACHINERY OF EVERY DESCRIPTION.

Cold Rolled Shafting.

HANGERS, PULLEYS, COUPLINGS, BELTING, &c &c. Send for Illustrated Catalogue and Price List.

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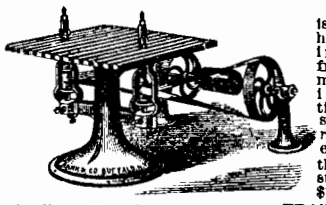
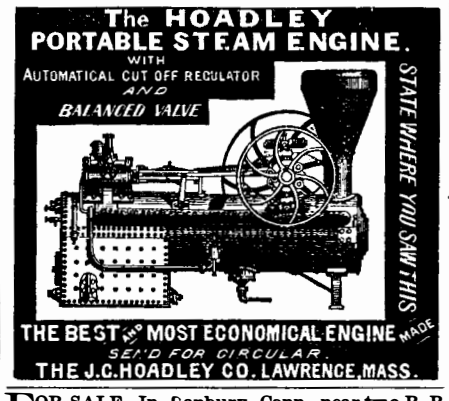
UPRIGHT SHAPING MACHINE.



This machine is built upon a heavy column instead of a frame, is much more simple in its construction. It is very strong and durable, and more easily operated than the old style. Price $125. Send for price list and catalogue.
FRANK & CO.,
182 Terrace St., Buffalo, N. Y.



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$50 to $10,000 Has been invested in Stock Privileges and paid 900 per cent. profit. "How to do it." A book on Wall Street, sent free. TUMBRIDGE & Co., Bankers, 2 Wall St., N. Y.

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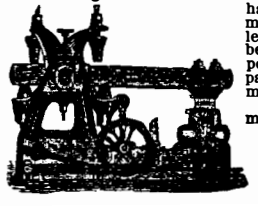

has larger capacity, is more durable, takes up less room, does more and better work with less expense for power and repairs than any other Hammer in use.
Guaranteed as recommended. Address
BRADLEY Manufacturing Company,
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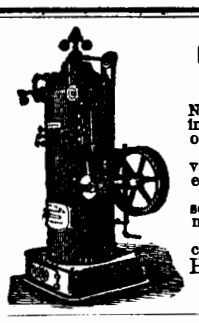

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Every Engine indicated, and valve corrected to give the highest attainable results.
Warranted superior to any semi-portable Engine in the market.
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BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for GOLD, SILVER, OR NICKEL PLATING. THOMAS HALL, Manufacturing Electrician, 19 Bromfield Street, Boston, Mass. Illustrated Catalogue sent free.

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With Scroll and Circular Saw Attachments, Slide Rest, Tools, &c.; also Small Engine Lathes, Metal Hand Planers, &c. Neatest designs, superior finish **Low Prices.** Our new Catalogue describes these and every tool necessary for the Amateur or Artizan. Send for it.
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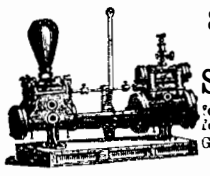

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Save 20 per cent in fuel. ROOFING IN EVERY STYLE.
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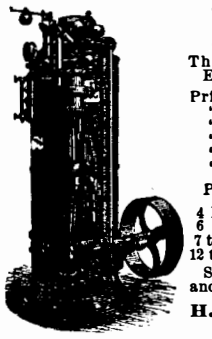

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Price, 4 Horse Power			$300
" 6 "	"		400
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" 8½ "	"		540
" 12 "	"		725
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Price of Stationary Engines:

4 Horse Power	$150
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7 to 8½ Horse Power	225
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An entire REVOLUTION in the construction of foot-power machines! The old style thrown aside when these are known! Thousands now in use! $1,500 to $2,000 per year made using them. One person out of every three who send for catalogues of these machines buys one. Say what paper you read this in, and address
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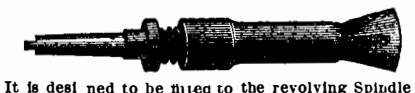

It is designed to be fitted to the revolving Spindle of any Lathe, for the purpose of finding and drilling centers in round Iron. Price $6.50.
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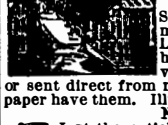

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Foot Power Back-geared Screw Lathes,

Small Hand and Power Planers for metal, Slide Rests, Ball Machines for Latnes, Foot Scroll Saws, light and heavy, Foot Circular Saws. All the very best. Sold by machinery agents, or sent direct from manufactory. Many readers of this paper have them. Illustrated Catalogues free.
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STATEMENT OF THE TRAVELERS

23D SEMI-ANNUAL STATEMENT OF THE TRAVELERS INSURANCE CO.

HARTFORD, CONN., JULY 1, 1875.

ASSETS.

Real estate owned by the company	$ 78,861 24
Cash on hand and in bank	115,423 38
Cash in hands of Agents, or in transmission	90,132 74
Loans on first mortgages real estate	1,824,877 50
Deferred premiums	71,944 05
Accrued interest	70,945 95
United States government bonds	380,740 00
State and municipal bonds	116,385 00
Railroad stocks and bonds	179,840 00
Bank and Insurance stocks	500,740 00
Bills Receivable	40,000 00
Total Assets	$3,470,319 86

LIABILITIES.

Reserve, four per cent, life department	$2,114,420 55
Reserve for re-insurance, accident dep't	169,003 18
Claims unadjusted and not due, and all other liabilities	168,634 95
Total liabilities	$2,452,062 68
Surplus as regards policy-holders	$1,018,257 18

Surplus as above, on four and one-half per cent. reserve, N. Y. standard, **$1,228,499 73.**

JAS. G. BATTERSON, President.
RODNEY DENNIS, Secretary.
JOHN E. MORRIS, Ass't Sec'y.

☞ NEW YORK OFFICE, 207 BROADWAY. ☜

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Carpets and Clothing, without injury to the most delicate color or Goods. The expense for material and labor to clear them from the largest Parlor Suit **will not exceed One Dollar.** For **ONE DOLLAR** we will forward recipe and instructions and GUARANTEE all we claim **or refund the money.** We refer to any National Bank in our City, and the Commercial Agency of Messrs. Dunn & Co.

NEWTON & DAVIS,
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TWIST DRILL GRINDING MACHINES, Expanding-Boring Bars, Self-Feeding Hand Drills, Rotary Shapers, Planers, Drilling Machines. C. VAN HAAGEN & CO., makers of improved Machine Tools, Phila.

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Stone and Ore Breaker

Crushes all hard and brittle substances to **any required size.** Also, any kind of STONE for ROADS and for CONCRETE, &c. Address BLAKE CRUSHER CO., New Haven. Conn.

FOOT LATHES.
Address WILLIAM E. LEWIS, Cleveland, Ohio.

$25 a day guaranteed using our well Auger & Drills. $100 a month paid to good Agents. Auger book free. Jilz Auger Co., St. Louis, Mo.

THE BEST INJECTOR
For Locomotive and Stationary Boilers.
FRIEDMANN'S PATENT.
Over 15,000 Now in Use Here and in Europe

Throws more and hotter water, with less steam, than any others. It has two Waterways, fixed Nozzles, and no movable parts to get out of order.

NATHAN & DREYFUS, Sole Manufacturers,
108 Liberty St., New York.
☞ Send for Catalogue.

THE TANITE COMPANY
Emery Wheels — TANITE — Emery Grinders
STROUDSBURG MONROE Co. PA.

Special Notice to Dealers in and Users of
Wood Working Machinery.

WORCESTER, MASS., May 25, 1875.

The undersigned, having purchased the entire Manufacturing Establishment of R. BALL & CO., including PATTERNS, PATENTS, GOOD WILL, CORRESPONDENCE, and everything pertaining to the business (book accounts excepted), will continue the manufacture of Wood Working Machinery, and be prepared to furnish new machines, or parts for repairs, as furnished by either concern in years past.

We shall at once remove our present Works to our new quarters—uniting the two establishments—and be able to furnish customers with improved Machinery, both in quality of stock and workmanship, and at reasonable prices.

We would take this opportunity to return our thanks to our old friends and customers, and would be most happy to see them at our new quarters (26 Salisbury Street), and would remind them that we shall continue to manufacture Wood Working Machinery generally, making a specialty of Woodworth, Daniels' and Dimension Planers, Surfacing Machines, Tenoning, Mortising, and Re-Saw Machines, Saw Benches, &c. Yours, respectfully,

WITHERBY, RUGG & RICHARDSON,
26 Salisbury St., Worcester, Mass., U.S.A.

RICHARDSON, MERIAM & CO., Manufacturers of the latest improved Patent Daniels' and Woodworth Planing Machines Matching, Sash and Molding, Tenoning, Mortising, Boring, Shaping, Vertical and Circular Re-sawing Machines, Saw Mills, Saw Arbors, Scroll Saws, Railway, Cut-off, and Rip-saw Machines Spoke and Wood Turning Lathes, and various other kinds of Wood-working Machinery. Catalogues and price lists sent on application. Manufactory, Worcester, Mass. Warehouse, 107 Liberty Street, New York.

IMPORTANT FOR ALL CORPORATIONS AND MANF'G CONCERNS.—**Buerk's Watchman's Time Detector,** capable of accurately controlling the motion of a watchman or patrolman at the different stations of his beat. Send for circular.

J. E. BUERK, P. O. Box 979, Boston, Mass.

N. B.—The suit against Imhaeuser & Co., of New York, was decided in my favor, June 10, 1874. Proceedings have been commenced against Imhaeuser & Co. for selling, contrary to the order of the Court, and especially the clock with a series of springs in the cover, and marked Pat'd Oct. 20, '74. Persons using these, or any other clocks infringing on my Patent, will be dealt with according to law.

WROUGHT IRON BEAMS & GIRDERS

THE Union Iron Mills, Pittsburgh, Pa. The attention of Engineers and Architects is called to our improved Wrought-Iron Beams and Girders (patented), in which the compound welds between the stem and flanges, which have proved so objectionable in the old mode of manufacturing, are entirely avoided. We are prepared to furnish all sizes at terms as favorable as can be obtained elsewhere. For descriptive lithograph address Carnegie Brothers & Co., Union Iron Mills, Pittsburgh, Pa.

PATENT COLD ROLLED SHAFTING.

The fact that this Shafting has 75 per cent greater strength, a finer finish, and is truer to gage, than any other in use, renders it undoubtedly the most economical. We are also the sole manufacturers of the CELEBRATED COLLINS' PAT. COUPLING, and furnish Pulleys, Hangers etc., of the most approved styles. Price list mailed on application to JONES & LAUGHLINS.
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190 S. Canal st., Chicago, Ill.
☞ Stocks of this Shafting in store and for sale by FULLER, DANA, & FITZ, Boston, Mass.
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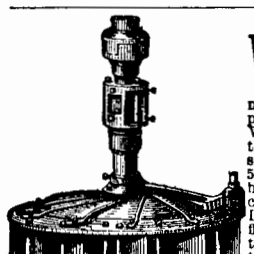

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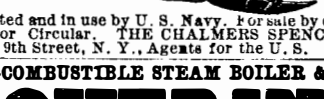

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